Georgia Department of Transportation

EDS545(53)

Widening of SR17/US 78 from SR 6 (Smith Mill Road) to South End of the Washington Bypass

P.I. No. 222255

McDuffie and Wilkes Counties, Georgia

Value Engineering Study Report

Concept Design Stage

March 2005

Design Consultant

CLARK PATTERSON ASSOCIATES

Value Engineering Consultant

Lewis & Zimmerman Associates, Inc.

Lewis & Zimmerman Associates, Inc.
Taking the Chance out of Change
6110 Executive Boulevard, Suite 512
Rockville, Maryland 20852-3903
301-984-9590 • Fax: 301-984-1369
info@lza.com • www.lza.com

March 3, 2005

Ms. Lisa L. Myers
Design Review Engineer Manager
State of Georgia Department of Transportation
General Office
No. 2 Capitol Square, Room 266
Atlanta, Georgia 30334-1002

re: Project Number EDS-545(53), Widening SR 17/US 78 from CR 6 (Smith Mill Road) to the South End of the Washington Bypass in McDuffie and Wilkes Counties, Georgia
Value Engineering Study Report

Dear Ms. Myers:

Lewis & Zimmerman Associates, Inc. is pleased to submit four hard copies and one electronic copy of the referenced report. The alternatives and design suggestion addressed during this VE effort deal with the primary focus areas and identify opportunities to improve the value of the project in terms of: improved safety; improved accessibility; accommodating economic development in accordance with the Governor's Roadway Improvement Program (G.R.I.P.); historic preservation; and improved constructibility.

We thank you and the Georgia Department of Transportation participants for assisting the VE team in generating creative, alternative solutions for this project. We look forward to working with you on future assignments are available to answer any questions you may have as you consider implementation.

Sincerely yours,

LEWIS & ZIMMERMAN ASSOCIATES, INC.

Luis M. Venegas, PE, CVS-Life
Vice President

Attachment

TABLE OF CONTENTS

EXECUTIVE SUMMARY

INTRODUCTION

This value engineering (VE) study report summarizes the events of the VE study conducted by Lewis & Zimmerman Associates, Inc. (LZA) for the State of Georgia Department of Transportation (GDOT), Atlanta, Georgia. The subject of the study was the widening of State Route (SR) 17/U.S. Route 78 from the County Route (CR) 6 (Smith Mill Road) the south end of the Washington Bypass also known as Project EDS-545(53), P. I. No. 222255, in McDuffie and Wilkes Counties, Georgia. The project is being designed by Clark Patterson Associates (CPA) from Suwanee, Georgia, and was at the Concept Design Stage at the time of the VE study.

PROJECT DESCRIPTION

The project proposes to widen SR 17/US 78 from County Route 6 to the north end of the Washington Bypass. The project will provide four, 3.60-meter (m) lanes with a 13.6-m depressed grass median for the entire 16.42 kilometers (km) of the project length. Because of adverse horizontal and vertical conditions and to avoid historic resources, the alignment would bypass Aonia to the west and continue on a new location east of and parallel to SR 17/US 78 from about the Williams Leverett House to the Washington Bypass. Access would be regulated by permit along the entire existing roadway and partially limited along the portion on the new location. The proposed right-of-way varies from 64m to 76m. A new parallel 137m x 11.6m bridge will be constructed over the Little River and the existing bridge will be widened to 11.6m. The existing roadway will remain open to traffic during construction. The project is part of the Governor's Road Improvement Program (G.R.I.P.)

The current probable cost of construction is $29,139,051 as noted on the Preliminary Cost Estimate, January 27, 2005. The project contains inflation at 5.00% per annum for three years (15.76%) and a contingency of 10.00%.

CONCERNS AND OBJECTIVES

When the project was first designed, the alignment of the widening to a four-lane limited access facility basically followed the alignment of the existing SR 17/US 78 roadway with safety and operational improvements such as straightening curves and widening the median. However, since the project was shelved for more than five years, an environmental reassessment was mandatory. During this reassessment, the northern portion of the project was required to be redesigned to accommodate/avoid numerous parcels of land, which had been classified as historical in the interim.

The southern portion of the project remained as originally designed and other than some bridge recommendations, did not receive much consideration for change as the design met the purpose and need of the approved Concept Report.

Emphasis was placed on the northern segment of the project due to its complete realignment to a new location and its impact on a relatively new residential subdivision.

To accomplish the project's goals in an expeditious and cost-effective manner, and to assist in ameliorating the concern noted, GDOT engaged this VE study. The objective of the effort was to identify opportunities that would improve the value of the project in terms of: historical preservation; corridor connection to accommodate the G.R.I.P.; economic development; improved safety; reduced capital cost, and improved constructibility.

HIGHLIGHTS OF THE STUDY

The project is a relatively straightforward widening of the SR 17/US 78 corridor in this eastern region of Georgia. Numerous ideas were development mainly along the lines of realignments in an attempt to minimize displacements, reduce right-of-way, and take advantage of the owned asset, i.e. the existing SR 17/US 78 roadway to the greatest extent possible. Listed below are some of the more salient ideas developed.

As noted on Alternative 13, the use of one-way pair roadways at the north end of the project commencing approximately at the treatment plant and finalizing at the north terminus – the Washington Bypass-could realize more than $3,000,000 in potential savings. The southbound lanes would use the existing SR 17/US 78 alignment and the northbound lanes would be located on the new location alignment. Less right-of-way (ROW) is required and the alternative takes advantage of the existing SR 17/US 78 asset with minimal impact on local residents and the historic land parcels.

Although acknowledging a change in position associated with a typical G.R.I.P. projects, Alternative 14 retains the alignment on the existing location from the Williams Leverett House north to the Washington Bypass, changing the typical section to four lanes with a 20-ft. raised median, urban shoulder treatments with curb and gutter, sidewalks, and a closed drainage system. The minimum ROW through this section would be 100 ft. wide which is within the existing ROW width. If this alternative were implemented, savings approaching $1,800,000 may be possible, albeit with a reduced speed limit in this section.

Due to delays in project execution during the late 1990s, the ensuing required environmental reassessment identified numerous parcels of ROW with historical significance. As such, the alignment of the widened roadway at the north end of the project took an easterly direction. Alternative 15 explores a western realignment rather than the longer eastern alignment assuming the current mapping's data is correct and there are only two historic properties on the west side: one small one in the vicinity of the project's northern terminus, which can be easily circumvented, and another larger parcel across from the Lincoln Bounds House in the vicinity of ±STA 400. If this new location comes to fruition, savings of about $1,300,000 may be possible.

Although the bridge length was inadvertently misrepresented, the initial savings of more than $1,400,000 can be credited to the project by optimizing the bridge design as noted on Alternative 4. This optimization simplifies the design by using only one beam type and making the spans the same lengths. This solution places bents in the river but away from the bank to reduce scouring effects.

The *Summary of Potential Cost Savings* worksheet following this narrative outlines all of the alternatives and design suggestion developed by the VE team. Some of the alternatives are mutually exclusive or interrelated so that the addition of all project cost savings does not equal total savings for

the project. A full listing of all of the ideas considered by the VE team can be found on the *Creative Idea Listing* worksheets in Section 4 of this report.

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **EDS-545(53), PI NO. 222255**
WIDENING SR 17/US 78 FROM SR 6/SMITH HILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	PRESENT WORTH OF COST SAVINGS: INITIAL COST SAVINGS	PRESENT WORTH OF COST SAVINGS: RECURRING COST SAVINGS	PRESENT WORTH OF COST SAVINGS: TOTAL PW LCC SAVINGS
4	Optimize the bridge design	$3,356,843	$1,929,610	$1,427,233		$1,427,233
6	Eliminate the intersection north of the Williams Leverett House	DESIGN SUGGESTION				
6A	Combine the T-intersections north of the Williams Leverett House	$0	$447,990	($447,990)		($447,990)
8	Eliminate the intersection at Reynolds Road	$17,430,675	$17,156,114	$274,561		$274,561
9	Eliminate limited access to further promote development	$433,798	$0	$433,798		$433,798
10	Simplify the Bellwood Road intersection with the widened SR 17/US 78 at the north end of project	DESIGN SUGGESTION				
11/12	Modify the alignment at the north end of the project	$900,000	$0	$900,000		$900,000
13	Use a one-way pair at north end of project	$3,253,219	$191,040	$3,062,179		$3,062,179
14	Reconfigure the new roadway from Williams Leverett House to the Washington Bypass	$20,974,699	$19,193,376	$1,781,323		$1,781,323
15	Shift alignment to the west	$1,294,656	$0	$1,294,656		$1,294,656
16	Project the new location alignment further north to a new north terminus	$2,500,000	$2,674,560	($174,560)		($174,560)
18	Balance the earthwork	DESIGN SUGGESTION				

STUDY RESULTS

INTRODUCTION

The results are the major feature of a value engineering study since they represent the benefits that can be realized on the project by the owner, users, and designer. The results will directly affect the project design and will require coordination among the designer, the user, and the owner to determine the ultimate acceptance of each alternative.

The creative ideas are organized according to the order in which they were originally generated by the VE team during their function analysis creative sessions.

RESULTS OF THE STUDY

The VE team generated 19 ideas for change during the Function Analysis and Creative Ideas phases of the VE Job Plan. The evaluation of these ideas was based upon their potential for capital cost savings, probability of acceptance, availability of information to properly develop an idea, compliance with perceived quality, adherence to universally-accepted standards and procedures, life cycle cost efficiency, safety, maintainability, constructibility, and soundness of the idea.

Of the 19 ideas generated, 15 were sufficiently rated to warrant further investigation. Continued research and development of these ideas yielded 10 alternatives for change with an impact on project costs. Three design suggestion will enhance the value of the project in terms of: improved safety, improved accessibility, accommodation for economic development in accordance with the Governor's Roadway Improvement Program (G.R.I.P.), and improved constructibility. All of these alternatives and design suggestions are presented in detail following this narrative and on the *Summary of Potential Cost Savings* worksheets.

EVALUATION OF ALTERNATIVES

It is important to consider each part of an individual alternative on its own merit. There may be a tendency to disregard an alternative because of concern about one portion of it. Consider each of the areas within an alternative that are acceptable and implement those parts in the final design, even if the entire alternative is not implemented.

Cost is the primary basis of comparison for alternative designs. To ensure that costs are comparable within the alternatives proposed by the VE team, the designer's cost estimates, where possible, is used as the pricing basis. Where appropriate, the impact of energy costs, replacement costs, and effect on operations and maintenance should be shown within each alternative.

Some of the alternatives are interrelated, so acceptance of one may preclude the acceptance of another. The reader should evaluate those alternatives carefully to select the ideas with the greatest beneficial impact to the project.

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **EDS-545(53), PI NO. 222255**
WIDENING SR 17/US 78 FROM SR 6/SMITH HILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	PRESENT WORTH OF COST SAVINGS: INITIAL COST SAVINGS	PRESENT WORTH OF COST SAVINGS: RECURRING COST SAVINGS	PRESENT WORTH OF COST SAVINGS: TOTAL PW LCC SAVINGS
4	Optimize the bridge design	$3,356,843	$1,929,610	$1,427,233		$1,427,233
6	Eliminate the intersection north of the Williams Leverett House	DESIGN SUGGESTION				
6A	Combine the T-intersections north of the Williams Leverett House	$0	$447,990	($447,990)		($447,990)
8	Eliminate the intersection at Reynolds Road	$17,430,675	$17,156,114	$274,561		$274,561
9	Eliminate limited access to further promote development	$433,798	$0	$433,798		$433,798
10	Simplify the Bellwood Road intersection with the widened SR 17/US 78 at the north end of project	DESIGN SUGGESTION				
11/12	Modify the alignment at the north end of the project	$900,000	$0	$900,000		$900,000
13	Use a one-way pair at north end of project	$3,253,219	$191,040	$3,062,179		$3,062,179
14	Reconfigure the new roadway from Williams Leverett House to the Washington Bypass	$20,974,699	$19,193,376	$1,781,323		$1,781,323
15	Shift alignment to the west	$1,294,656	$0	$1,294,656		$1,294,656
16	Project the new location alignment further north to a new north terminus	$2,500,000	$2,674,560	($174,560)		($174,560)
18	Balance the earthwork	DESIGN SUGGESTION				

VALUE ENGINEERING ALTERNATIVE

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17/US 78 FROM SR 6/SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 4

DESCRIPTION: **OPTIMIZE THE BRIDGE DESIGN**

ORIGINAL DESIGN: (Sketch attached)

The original design spans the Little River with a solution using small end spans to establish the required hydraulic opening. The center span was based on 10-ft. setbacks from the top of the bank. It is noted that the top of the bank stations were incorrect.

ALTERNATIVE: (Sketch attached)

This alternative acknowledges the river cannot be spanned with prestressed concrete beams which are commonly used for this type of river crossing. The alternative simplifies the current design by using only one beam type and making the spans the same lengths. This solution places bents in the river but places them away from the bank to reduce scouring.

ADVANTAGES:

- Provides a shallower main span
- Uses only one beam type
- Eliminates risers on intermediate piers
- Addresses error in original layout
- Imposes problematic hauling requirements
- Facilitates construction
- Shortens erection time

DISADVANTAGES:

- Requires cofferdams—original design would likely have required them too

DISCUSSION:

Simplification of the new bridge over the Little River facilitates the construction effort associated with the bridge and takes advantage of using a single beam type to reduce the overall cost during bidding due to economy of scale. Although bents are required within the river, they would be placed away from the banks to minimize or eliminate the scouring effect of the water flow.

The savings noted below do not take into account any potential savings of lowering the grade. Although the existing bridge cost of $135.63/SF is apparently an error, the savings noted are, in fact, warranted as the bottom line of the project includes this incorrect cost.

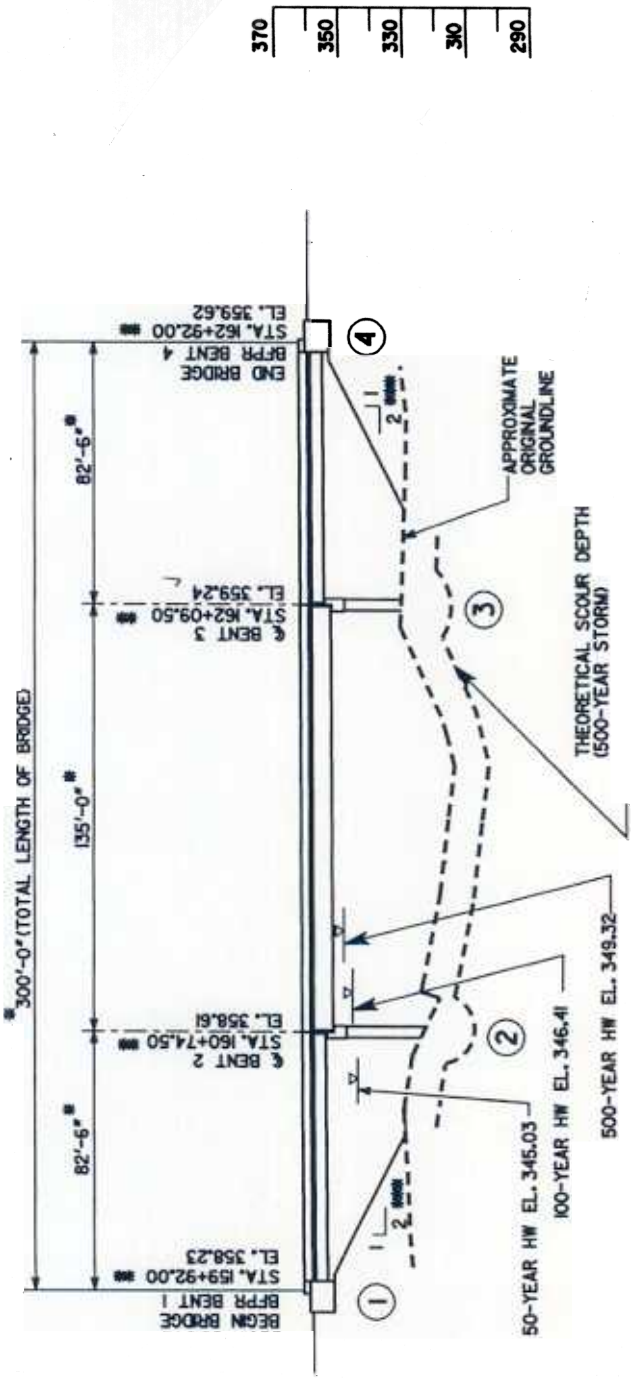
COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 3,356,843**	¾	**$ 3,356,843**
ALTERNATIVE	**$ 1,929,610**	¾	**$ 1,929,610**
SAVINGS	**$ 1,427,233**	¾	**$ 1,427,233**

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 4

■ AS DESIGNED ☐ ALTERNATIVE

SHEET NO.: 2 of 11



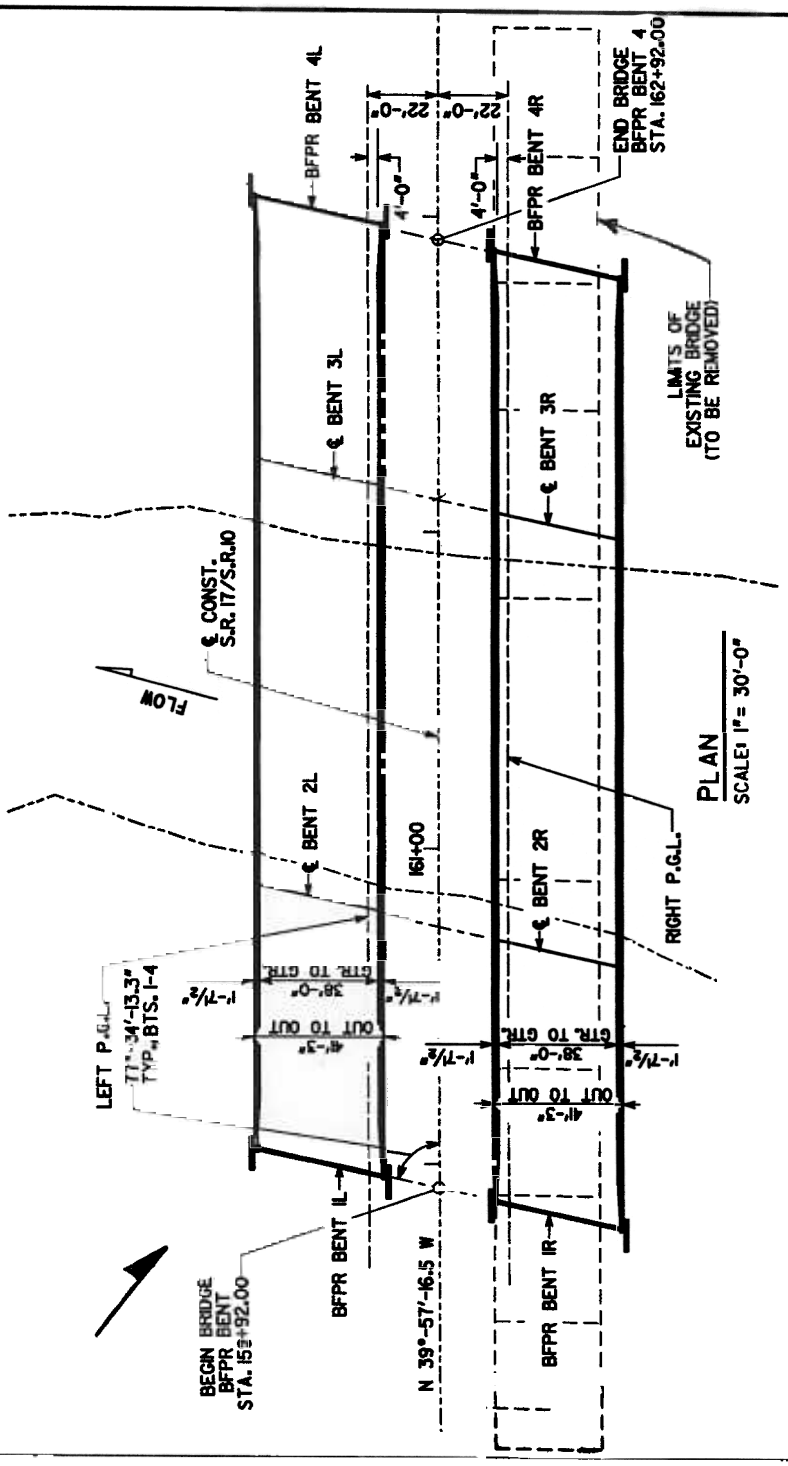
SKETCHES

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 4

■ AS DESIGNED ❑ ALTERNATIVE

SHEET NO.: 3 of 11



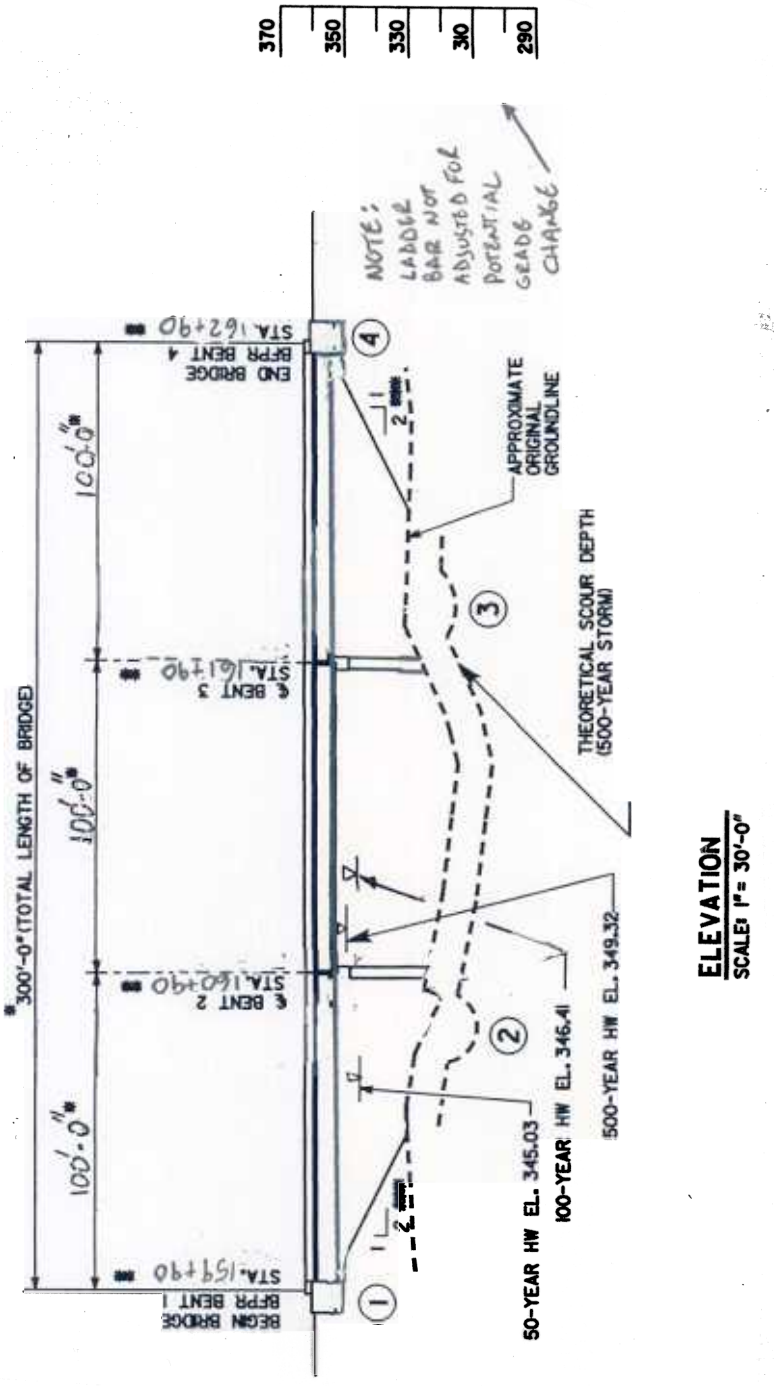
SKETCHES

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 4

☐ AS DESIGNED ■ ALTERNATIVE

SHEET NO.: 4 of 11



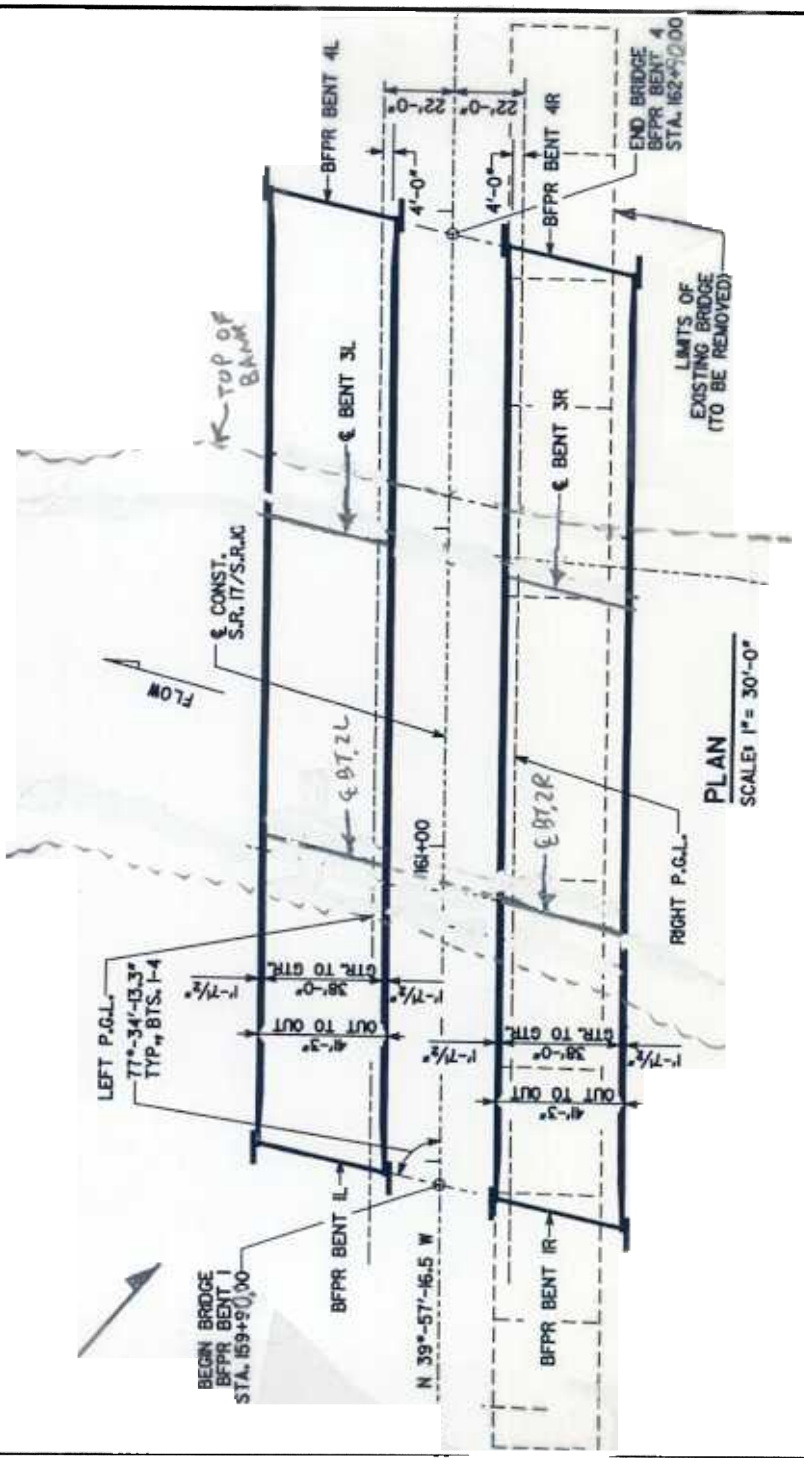
SKETCHES

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 4

☐ AS DESIGNED ■ ALTERNATIVE

SHEET NO.: 5 of 11



PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 4

DESCRIPTION: OPTIMIZE BRIDGE DESIGN

SHEET NO.: 6 of 11

VE STUDY | EDS - 545 (53) | GRANT 2-15-05 | #4

OPTIMIZE BRIDGE DESIGN

check freeboard on new bridge

SPAN	LOWEST PGL DECK ELEV	S.E. DROP TO OUTSIDE BM.	STRUCT. DEPTH	BOT. BEAM
Span 1	358.23′	− 34′ x .02 = 0.68′	− 4.75′	= 352.8
SPAN 2	358.61′	− 0.68′	− 7′	= 350.93
SPAN 3	359.24′	− 0.68′	− 4.75′	= 353.81

CONTROLS

STRUCTURE DEPTHS

		USE
SPANS 1 & 3 :	72″ Beam + 8″ SLAB + 3″ COPING = 83″	7′
SPAN 2 :	45″ BEAM + 8″ SLAB + 3″ COPING = 56″	4.75

CONTROLLING ELEVATIONS:

HIGHWATER FROM PRELIM. LAYOUT

BOT. OF BM. MINIMUMS

100 yr. = 346.41 + 1′ = 347.41 ← CONTROLS

50 yr. = 345.03 + 2′ = 347.03

(350.93 − 347.41)

IS THE PROFILE 3.52′ TOO HIGH?

SPOKE WITH SUSAN BECK (GDOT BRIDGE HYDRAULICS). MS. BECK AGREES WITH THE BOTTOM OF BEAM MINIMUMS LISTED ABOVE.

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 4

DESCRIPTION: OPTIMIZE BRIDGE DESIGN

SHEET NO.: 7 of 11

VE STUDY | EDS-545(53) GRANT 2-15-05

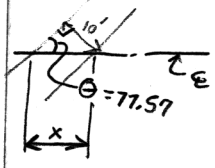
INTERMEDIATE PIER PLACEMENT

FROM THE CENTERLINE PROFILE THE TOP OF BANK APPEARS TO BE ELEVATION 329 ± 1'.

THE STATIONS AT TOP OF BANK APPEAR TO BE:

160+70 and 162+10

IF 10' setbacks to ℄ columns then subtract/add $10'/\sin(77.57) = 10.24$



$\frac{10}{x} = \sin\Theta$

$x = 10/\sin\Theta$

SO, BENT STATIONS WOULD BE:

160+70 − 10.24' = 160+59.76
162+10 + 10.24' = 162+20.24
} 160.48'

BRIDGE PRELIM LAYOUT INDICATES TOP OF BANK EQUAL TO

160+84 and 161+93

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 4

DESCRIPTION: OPTIMIZE BRIDGE DESIGN

SHEET NO.: 8 of 11

VE STUDY | EDS-545(53) GRANT 2-15-05

THE VE TEAM SPOKE WITH THE BRIDGE ENGINEER (SASTRY & ASSOC.). THEY AGREE THAT THE VE TEAM TOP OF BANK STATIONS ARE CORRECT. THE VE TEAM ALSO SPOKE WITH SUSAN BECK (GDOT BRIDGE HYDRAULICS). MS BECK AGREES WITH THE VE TEAM TOP OF BANK STATIONS AS WELL.
THE INTERMEDIATE BENT STATIONS MUST CHANGE.
SO,

THE 160.48' SPAN CREATED BY THE NEW TOP OF BANK STATIONS IS NOT ACHIEVABLE WITH 72" BULB TE

THE BENTS SHOULD NOT BE PLACED AT TOP OF BANK OR CLOSE TO THE EDGE OF STREAM. (THIS CONDITION INCREASES SCOUR AT THE BENTS).

WITH THE BRIDGE @ 300' LONG:
SUGGEST MAKE 3 EQUAL SPANS (100')
AND COME IN EQUALLY INTO THE STREAM ON BOTH SIDES.

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 4

DESCRIPTION: OPTIMIZE BRIDGE DESIGN

VE STUDY | EDS - 545 (53) GRANT 2-15-05

CALCULATE CENTER OF BRIDGE

$$\begin{array}{r} 16210 \\ -\ 16070 \\ \hline 140' \end{array}$$

$140'/2 = 70'$

$\overbrace{160+70}^{\text{STATION}} + 70' = 161+40$ ← center of bridge

BENT	STATION	
1	159+90	
	← TOP OF BANK = 160+70	← 20' OFFSET
2	160+90	
center	161+40	
3	161+90	
	← TOP OF BANK = 162+10	← 20' OFFSET
4	162+90	

USE 54" BULB T FOR 100' SPAN

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 4

DESCRIPTION: OPTIMIZE BRIDGE DESIGN

VE STUDY | EDS-545(53) GRANT 2-15-05

RECALCULATE AMOUNT THAT PROFILE CAN BE LOWERED

SPAN	CONTROLLING ELEVATION	STRUCTURE DEPTH	↓ PROV. CALC SE	MIN. TOP OF DECK
SPAN 1	347.41′ +	5.5′	+ 0.68′ =	353.59′
SPAN 2	347.4 +	5.5	+ 0.68′ =	353.59
SPAN 3	347.41′ +	5.5	+ 0.68 =	353.59′

STRUCTURE DEPTH 54" BULB T = 54" + 8" (↓ slab) + 3" (↓ coping) = 65" SAY 5′-6"

SO,

IF TOP OF DECK @ ℄ BR. EXCEEDS 353.59′

THEN THE STRUCTURE CLEARS THE CONTROLLING HIGH WATER CONDITION.

THIS MEANS THAT PGL @ THE BRIDGE CAN BE LOWERED 4.64′ WITHOUT CHANGING THE HYDRAULICS.

THIS MAKES SENSE BECAUSE WE PREVIOUSLY THOUGHT THE GRADE WAS 3.52′ HIGH (page 1) AND WE INCREASED THIS BY THE DIFF. IN HEIGHT FROM A 72" BULB TEE TO A 54" BULB TEE (1.5′). NOTE: THE CONTROLLING SPAN SHIFTED TO SPAN 1.

COST WORKSHEET

PROJECT: **EDS-545(53), PI NO. 222255**
WIDENING SR 17 / US 78 FROM SR 6 / SMITH HILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties

ALTERNATIVE NO: 4

DESCRIPTION

SHEET NO. 11 of 11

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Bridge Area: (38 LF Wide Lane + (1.625 LF Sideboard x 2 Sides)) x 300 LF Length of Bridge x 2 Bridges = 24,750 SF							
As-Designed Bridge Cost: Per cost estimate, the lump sum bridge cost is $2,770,000 / 24,750 SF = $111.92/SF. Escalating to mid-point of construction (June 2007) would render (1.03^6.5) x $111.92/SF = $135.63/SF. [This is considered to be an error.]							
New Bridge Cost: A rural PSC bridge with concrete bents in year 2000 runs about $64.00/SF. Escalating to mid-point of construction (June 2007) would render (1.03^6.5) x $64.00/SF = $77.56/SF.							
As-Designed Bridges	SF	24,750	135.63	3,356,843			
New Bridges	SF				24,750	77.56	1,919,610
	Sub-total			3,356,843			1,919,610
Mark-up at	**See Above**			See Above			See Above
	TOTAL			3,356,843			1,919,610

VALUE ENGINEERING ALTERNATIVE

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17/US 78 FROM SR 6/SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 6

DESCRIPTION: **ELIMINATE THE INTERSECTION NORTH OF THE WILLIAMS LEVERETT HOUSE**

ORIGINAL DESIGN: (Sketch attached)

The original design creates a cul-de-sac of SR 17/US 78 on the northeast side of the Big Cedar Road T-intersection. A new T-intersection is created north of the Williams Leverett House approximately 2,700 ft. from Big Cedar Road. A third T-intersection is created 2,800 ft. further north along the proposed SR 17/US 78 new alignment with the existing SR 17/US 78 alignment.

ALTERNATIVE: (Sketch attached)

Eliminate the new T-intersection north of the Williams Leverett House and the cul-de-sac SR 17/US 78 at that same point. The intersection with Big Cedar Road then becomes a four-leg intersection. The T-intersection with the existing SR 17/US 78, now 5,500 feet from Big Cedar Road, is retained.

ADVANTAGES:

- Improves access control
- Improves overall safety
- Eliminates one cul-de-sac
- Reduces the number of access points onto SR 17/US 78

DISADVANTAGES:

- Slightly reduces user convenience
- Requires a bit more travel to access SR 17/US 78 at this end of the project

DISCUSSION:

Since the right-of-way takes and pavement quantities are approximately the same, there is no initial cost savings. However, the intangible costs associated with improved safety and traffic flow are better executed with this solution.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE	DESIGN SUGGESTION		
SAVINGS			

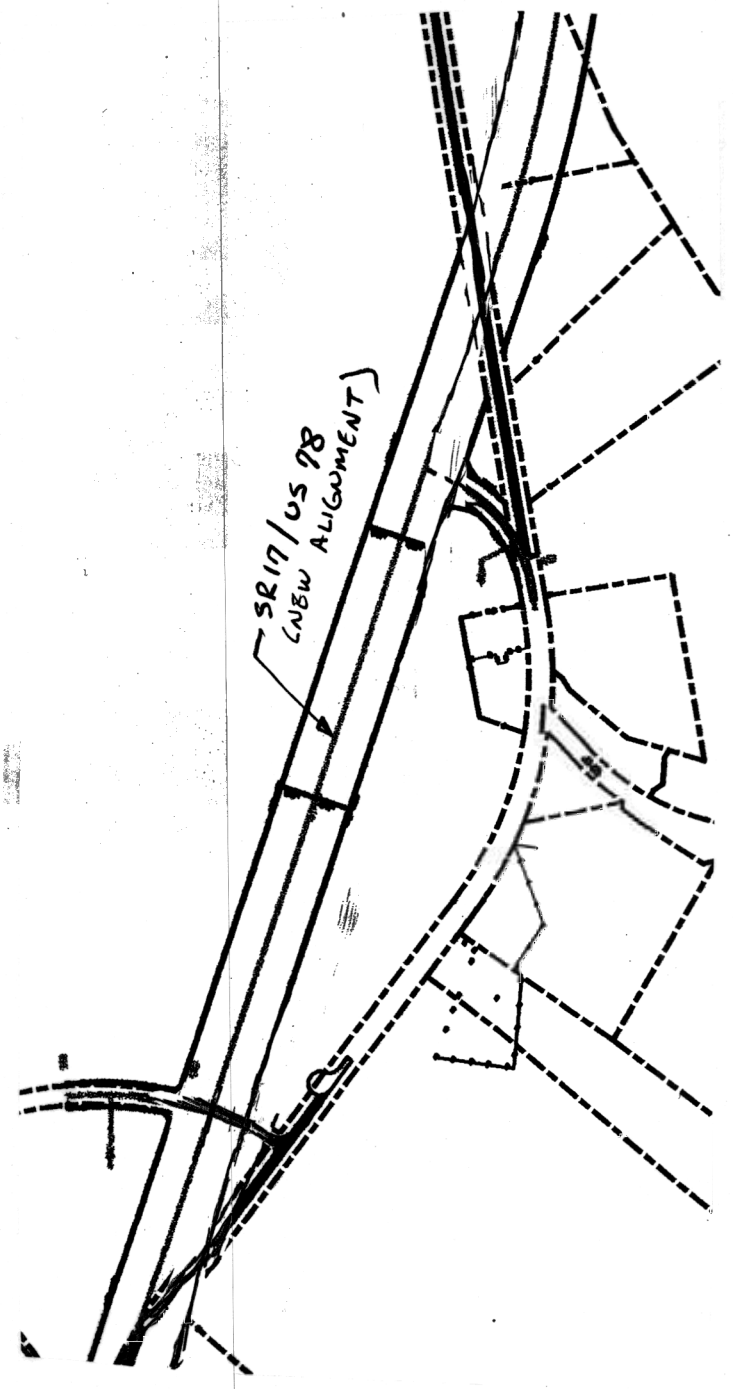
SKETCHES

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 6

■ AS DESIGNED ☐ ALTERNATIVE

SHEET NO.: 2 of 5



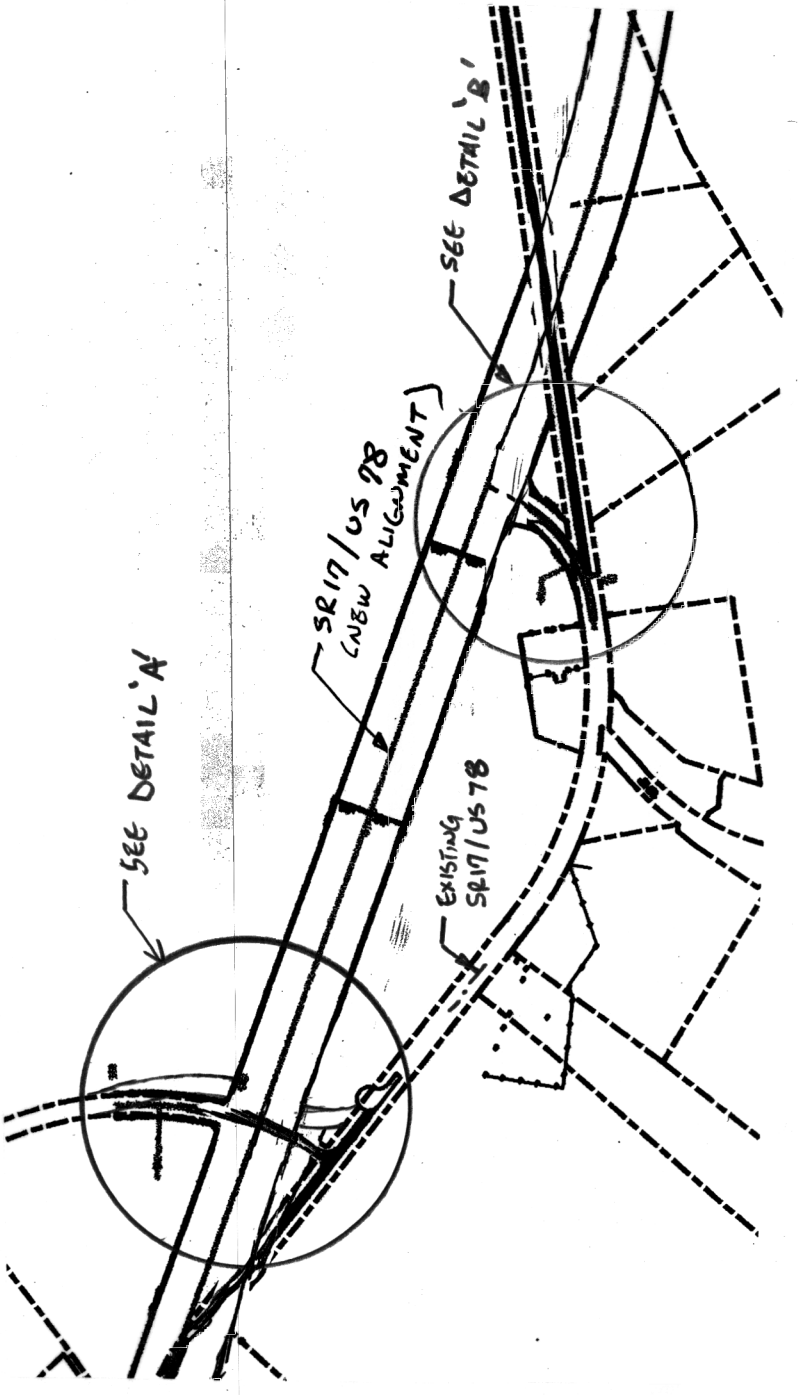
SKETCHES

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 6

☐ AS DESIGNED ■ ALTERNATIVE

SHEET NO.: 3 of 5



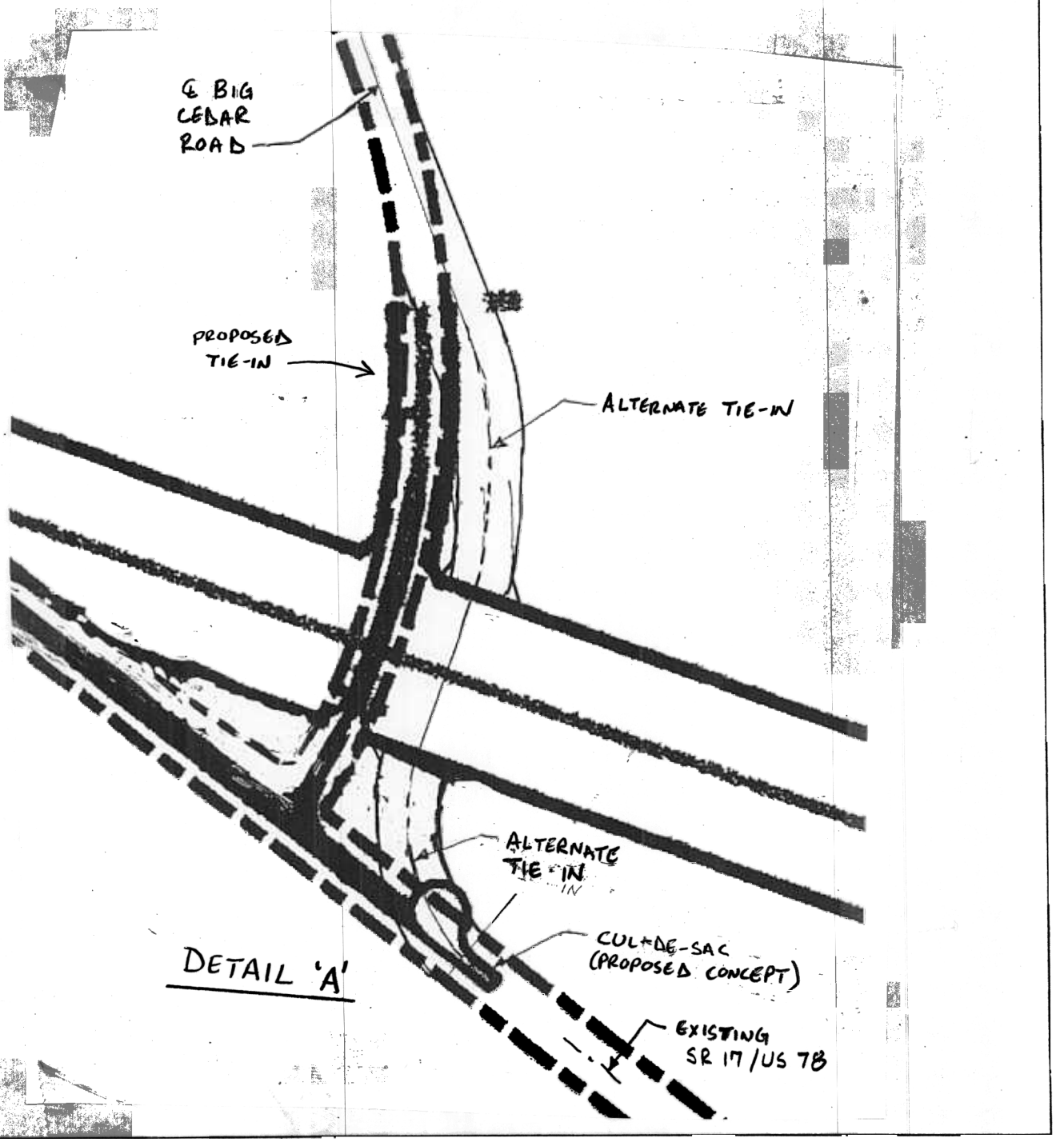
SKETCHES

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 6

☐ AS DESIGNED ■ ALTERNATIVE

SHEET NO.: 4 of 5



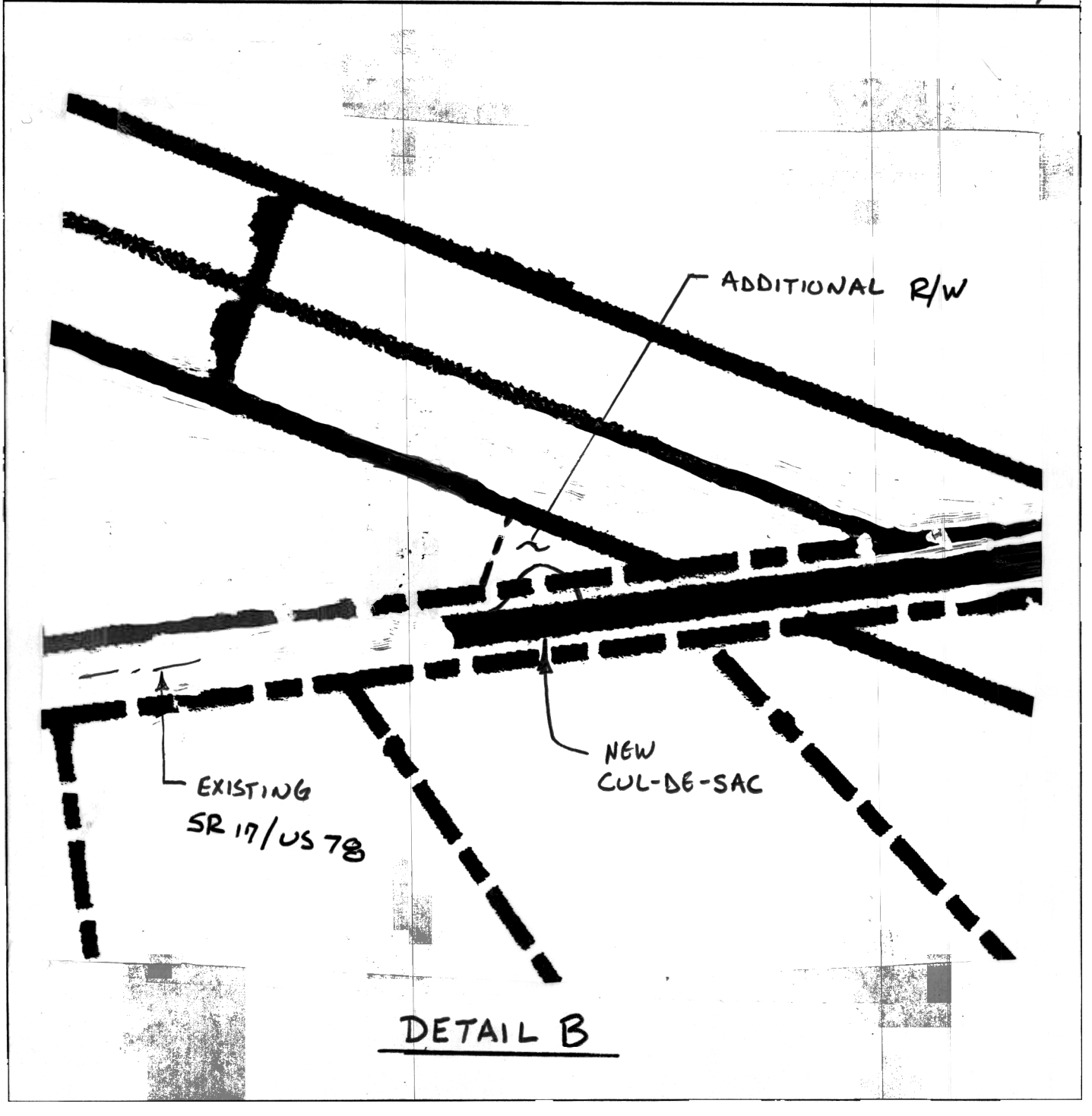
SKETCHES

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 6

☐ AS DESIGNED ■ ALTERNATIVE

SHEET NO.: 5 of 5



DETAIL B

VALUE ENGINEERING ALTERNATIVE

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17/US 78 FROM SR 6/SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 6A

DESCRIPTION: **COMBINE THE T-INTERSECTIONS NORTH OF THE WILLIAMS LEVERETT HOUSE**

ORIGINAL DESIGN: (Sketch attached)

The proposed new alignment severs the existing SR 17/US 78 facility and reestablishes access with two T-intersections approximately 2,800 ft. part.

ALTERNATIVE: (Sketch attached)

Realign a portion of the existing SR 17/US 78 to allow a four-leg intersection just north of the Williams Leverett House.

ADVANTAGES:

- Improves access control
- Improves overall safety
- Eliminates one cul-de-sac
- Reduces the number of access points onto SR 17/US 78

DISADVANTAGES:

- Slightly reduces user convenience
- Requires a bit more travel to access SR 17/US 78 at this end of the project
- Increases initial cost

DISCUSSION:

Although increasing the initial cost of the project, from an operational and safety aspect, the added cost appears to be prudent.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 0**	¾	**$ 0**
ALTERNATIVE	**$ 447,990**	¾	**$ 447,990**
SAVINGS	**$ (447,990)**	¾	**$ (447,990)**

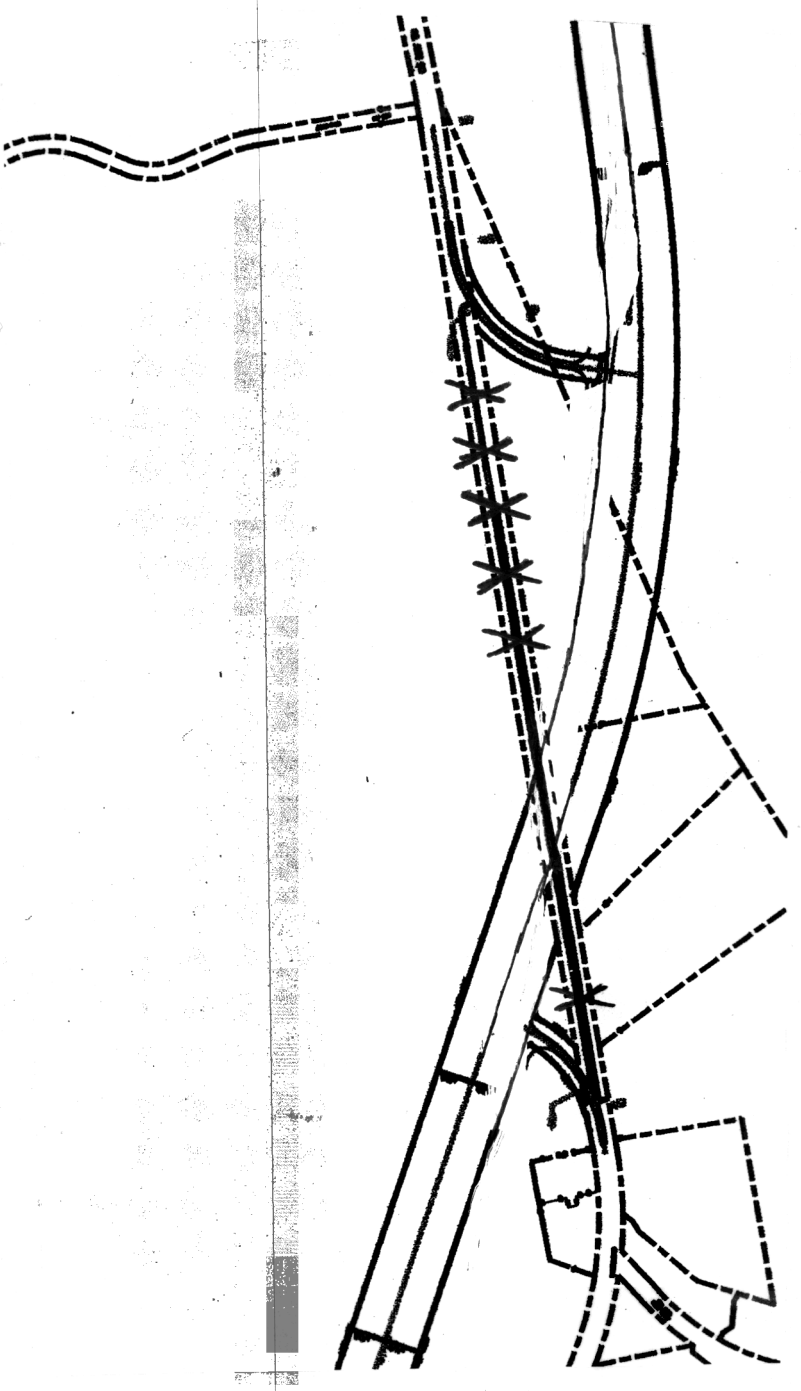
SKETCHES

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 6A

■ AS DESIGNED ☐ ALTERNATIVE

SHEET NO.: 2 of 5



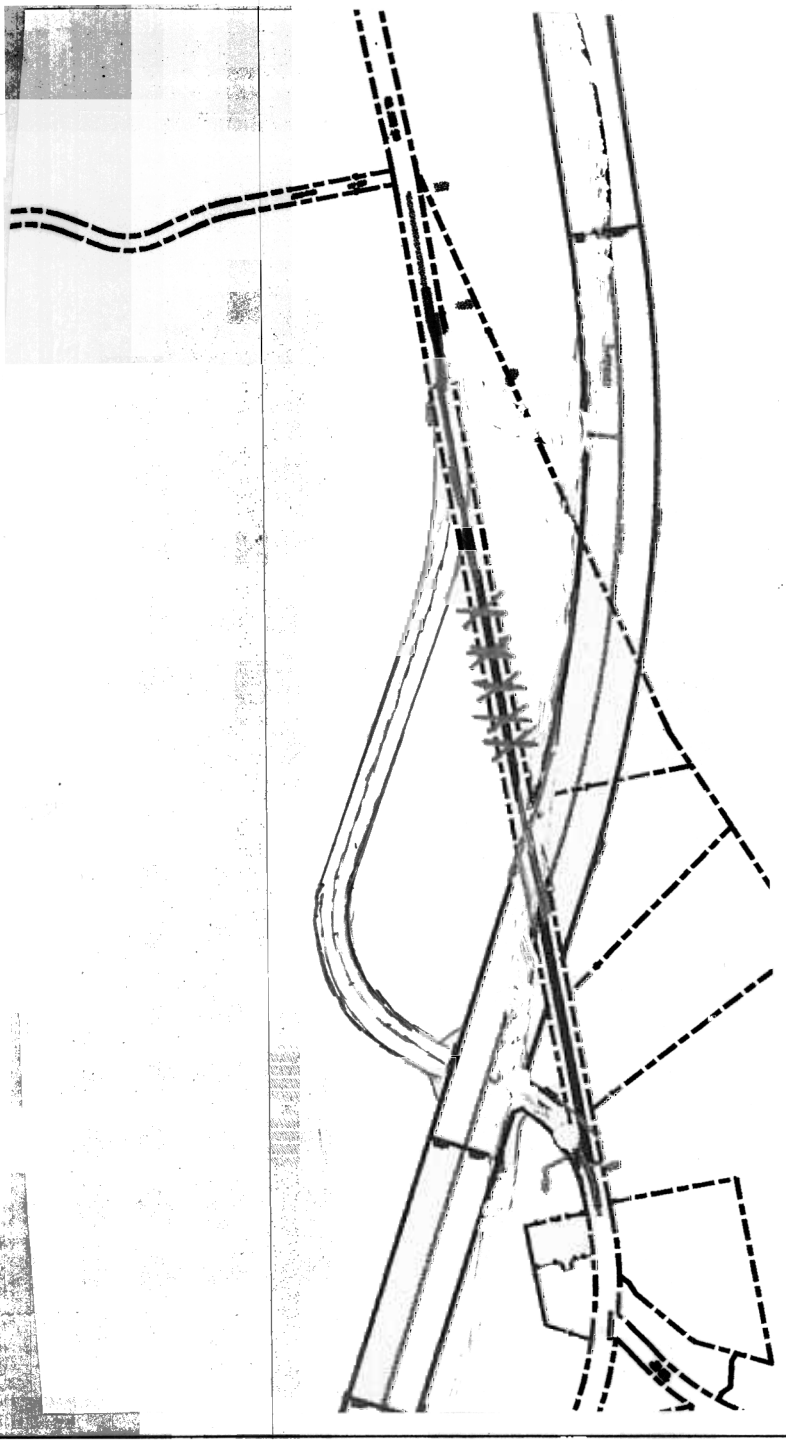
SKETCHES

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 6A

☐ AS DESIGNED ■ ALTERNATIVE

SHEET NO.: 3 of 5



CALCULATIONS

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 6A

DESCRIPTION: COMPUTE T [illegible] ONE SIDE OF WILLIAMS [illegible]

SHEET NO.: 4 of 5

SIDE ROAD / UNIT COST / LINEAR FOOT

(24 FEET WIDE) 1 ft $\left(\frac{1}{9}\right) yd^2 = 2.67 \frac{yd^2}{ft}$

$2.67 \frac{yd^2}{ft} \left(50 \frac{\$}{SY}\right) = 133 \frac{\$}{ft^2}$

$\Rightarrow$ USE 150 $/ft

COST WORKSHEET

PROJECT: **EDS-545(53), PI NO. 222255**
WIDENING SR 17 / US 78 FROM SR 6 / SMITH HILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties

ALTERNATIVE NO: 6A

DESCRIPTION

SHEET NO. 5 of 5

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Additional Roadway/ROW	LF				2,000	150.00	300,000

	Sub-total			300,000
Mark-up at	49.33%			147,990
	TOTAL			447,990

VALUE ENGINEERING ALTERNATIVE

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17/US 78 FROM SR 6/SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 8

DESCRIPTION: **ELIMINATE INTERSECTION AT REYNOLDS ROAD**

ORIGINAL DESIGN: (Sketch attached)

The original design provides an intersection at Reynolds Road for an unimproved dirt access road.

ALTERNATIVE: (Sketch attached)

Remove the intersection at Reynolds Road. Reynolds Road will have access to the new alignment via existing SR 17/US 78 and other proposed intersections.

ADVANTAGES:

- Saves initial cost
- Provides better access control
- Improves overall safety
- Reduces the number of access points onto SR 17/US 78
- Minimizes/eliminates through traffic within the historic property
- Maintains historic preservation

DISADVANTAGES:

- Slightly reduces user convenience
- Reduces access points along the new location
- Limits development opportunities for undeveloped properties – but could be added later

DISCUSSION:

Reynolds Road is an existing road traveling through an historic property on the south side of the relocated SR 17/US 78. On the north side, Reynolds Road is an unimproved dirt access road to an undeveloped property. Eliminating this intersection will result in traffic on Reynolds Road south of the relocated SR 17/US 78 to access the new location via existing SR 17/US 78 at other proposed intersections. Reynolds Road north of the relocated SR 17/US 78 will not have access.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 17,430,675**	¾	**$ 17,430,675**
ALTERNATIVE	**$ 17,156,114**	¾	**$ 17,156,114**
SAVINGS	**$ 274,561**	¾	**$ 274,561**

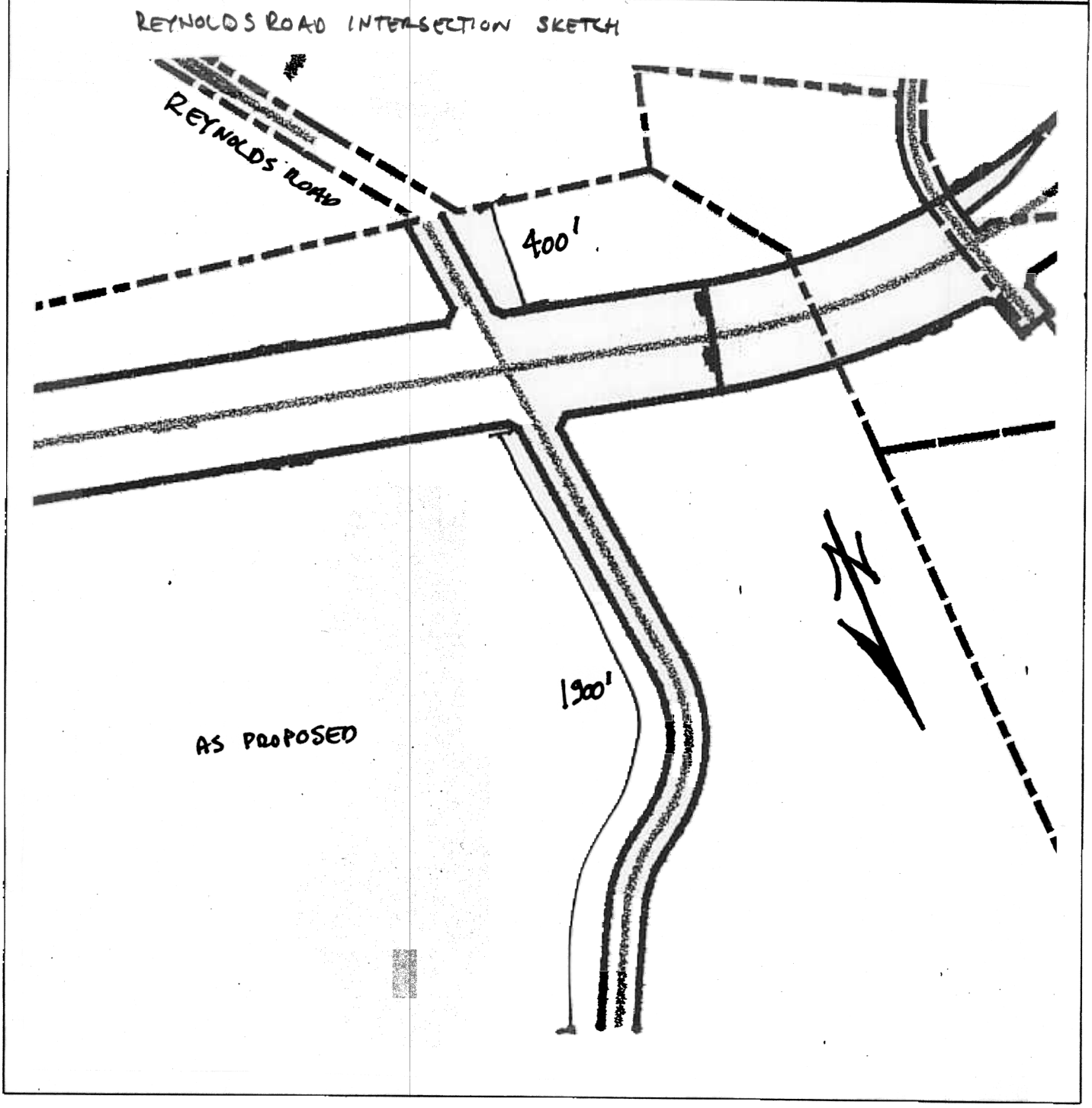
SKETCHES

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 8

☒ AS DESIGNED ☐ ALTERNATIVE

SHEET NO.: 2 of 7



SKETCHES

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

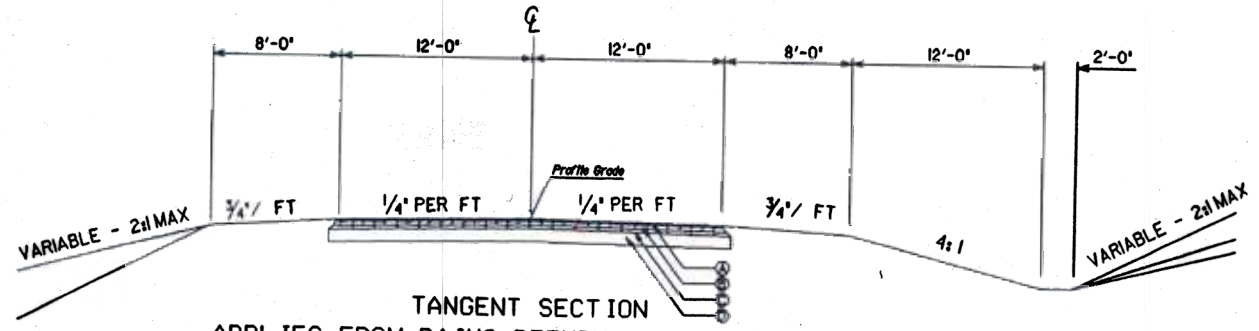
ALTERNATIVE NO.: 8

☒ AS DESIGNED ☐ ALTERNATIVE

SHEET NO.: 3 of 7

REYNOLDS ROAD TYPICAL SECTION

TS-5



TANGENT SECTION
APPLIES FROM RAIUS RETURN TO END OF WORK
MOORE ROAD
BIG CEDAR ROAD
TIE IN TO OLD SR 17 (RT)
TIE IN TO OLD SR 17 (RT)
REYNOLDS ROAD
BELLWOOD ROAD (RT & LT)
UPTON MILL ROAD

SKETCHES

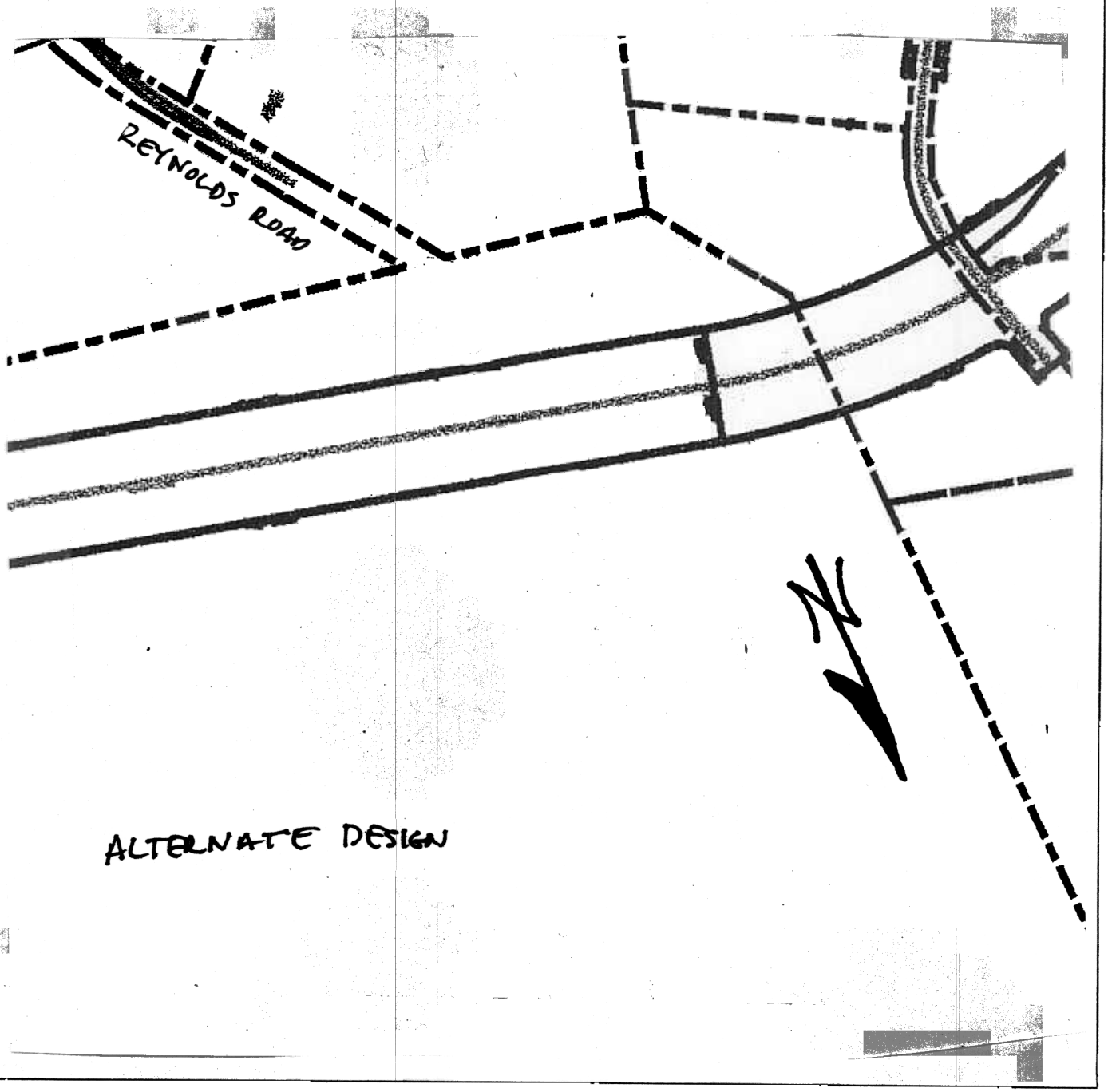
PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 8

☐ AS DESIGNED ☒ ALTERNATIVE

SHEET NO.: 4 of 7

ELIMINATING REYNOLDS ROAD INTERSECTION



ALTERNATE DESIGN

CALCULATIONS

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 8

DESCRIPTION: ELIMINATE INTERSECTION AT REYNOLDS ROAD

SHEET NO.: 5 of 7

ELIMINATING THE INTERSECTION AT REYNOLDS ROAD WILL RESULT IN CONSTRUCTION COST SAVINGS AND RIGHT OF WAY SAVINGS.

CONSTRUCTION COSTS - ELIMINATING THIS INTERSECTION WILL ELIMINATE IMPROVEMENTS ALONG REYNOLDS ROAD. REYNOLDS ROAD IS PROPOSED AS A 2-LANE RURAL ROAD. THE TYPICAL SECTION CALLS FOR 2-12' LANES, 6' GRASS SHOULDERS AND OPEN CHANNEL DRAINAGE SYSTEM. PAVEMENT SELTION CALLS FOR 165#/SY 12.5mm ; 220#/SY 19mm ; 440#/SY 25mm ; 8" GAB. LENGTH OF PROPOSED IMPROVEMENTS ON SOUTH SIDE OF SR 17 IS 400'. LENGTH OF PROPOSED IMPROVEMENTS ON NORTH SIDE OF SR 17 IS 1900'.

AREA OF PROPOSED PAVEMENT - L x W = (400+1900) x (2x12) = 55200 SF = 6140 SY

12.5mm = 6140 SY x 165#/SY = 507 TON x $36.61 = $18562
19mm = 6140 SY x 220#/SY = 675 TON x $38.08 = $25704
25mm = 6140 SY x 440#/SY = 1350 TON x $36.57 = $49370
GAB = 6140 SY x $\frac{8"}{12"}$ x $\frac{1'}{3'}$ x 2 TON/CY = 2729 TON x $19.24 = $53101

EARTHWORK

STA	AREA	VOL	CUM VOL
7+00	0	-	-
7+50	30	28	28
8+00	30	56	84
8+50	40	65	149
9+00	120	149	298
9+50	140	241	539
10+00	225	338	877
10+50	320	505	1382
11+00	400	741	2123
11+50	535	996	3119
12+00	765	1260	4379
12+50	1035	1667	6046

STA	AREA	VOL	CUM VOL
13+00	1170	2042	8088
13+50	1235	2227	10315
14+00	1170	2227	12542
14+50	1210	2204	14746
15+00	1125	2163	16909
15+50	1020	1982	18891
16+00	935	1811	20702
16+50	525	1352	22054
17+00	250	718	22772
17+50	280	491	23263
18+00	90	343	23606
18+50	90	121	23727
19+00	0	38	23765

UNCLASSIFIED EXC. - 23765 CY x $2.44 = $57987

CALCULATIONS

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 8

DESCRIPTION: ELIMINATE INTERSECTION AT REYNOLDS ROAD

SHEET NO.: 6 of 7

CONSTRUCTON COST SUMMARY

ORIGINAL ESTIMATE

12.5mm - $1219589 TN
19mm - $1651759 TN
25mm - $2418411 TN
GAB - $3359332 TN
UNCL. EXC. - $3,677,000 LS.

ALTERNATE

12.5mm = $1219589 - $18562 = $1201027
19mm = $1651759 - $25704 = $1626055
25mm = $2418411 - $49370 = $2369041
GAB = $3354332 - $53101 = $3301231
UNCL. EXC. = $3677000 - $57987 = $3619013

RIGHT OF WAY ESTIMATE

° ELIMINATING INTERSECTION WILL ELIMINATE NEED FOR R/W.
LENGTH OF IMPROVEMENTS ALONG REYNOLDS ROAD = 400 + 1900 = 2300'
WIDTH OF REQD R/W = 100'

AREA OF REQD R/W = 2300 x 100 = 230000 SF = 5.3 AC

COST SAVINGS = 5.3 AC x $6000 /AC = $31800

SUMMARY

ORIGINAL - $1741000
ALTERNATE - $1741000 - $31800 = $1709200

COST WORKSHEET

PROJECT: **EDS-545(53), PI NO. 222255**
WIDENING SR 17 / US 78 FROM SR 6 / SMITH HILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties

ALTERNATIVE NO: 8

DESCRIPTION

SHEET NO. 7 of 7

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Construction Items							
12.5mm asphalt	TN	33,313	36.61	1,219,589	32,806	36.61	1,201,028
19.0mm asphalt	TN	43,376	38.08	1,651,758	42,701	38.08	1,626,054
25.0mm asphalt	TN	66,131	36.57	2,418,411	64,781	36.57	2,369,041
GAB	TN	235,557	14.24	3,354,332	232,828	14.24	3,315,471
Unclassified Excavation	LS	1		3,677,000	1		3,619,013
Subtotal				12,321,089			12,130,607
Mark-Up @ 27.34%	%		27.34%	3,368,586		27.34%	3,316,508
Total Construction				15,689,675			15,447,114
Right-of-Way	LS	1		1,741,000	1		1,709,000

		ORIGINAL TOTAL	PROPOSED TOTAL
	Sub-total	17,430,675	17,156,114
Mark-up at		INCL	INCL
	TOTAL	17,430,675	17,156,114

VALUE ENGINEERING ALTERNATIVE

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17/US 78 FROM SR 6/SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 9

DESCRIPTION: **ELIMINATE LIMITED ACCESS TO FURTHER PROMOTE DEVELOPMENT**

ORIGINAL DESIGN:

The original design widens SR 17/US 78 from CR 6 to the Washington Bypass. From CR 6 to Big Cedar Road, the existing pavement is widened and access is maintained with the current configuration. From Big Cedar Road to the Washington Bypass, the road is relocated and offers limited access.

ALTERNATIVE:

From Big Cedar Road to the Washington Bypass, construct the widened roadway as shown but do not make the relocated road limited access. Retain the access controlled as in the section from CR 6 to Big Cedar Road.

ADVANTAGES:

- Saves initial cost
- Promotes further development
- Complies with the G.R.I.P.
- Potentially increases the number of access points

DISADVANTAGES:

- Ultimately results in lower through-speeds
- Ultimately increases safety concerns

DISCUSSION:

In accordance with the approved Concept Report, the SR 17/US 78 improvements are part of the G.R.I.P. This involves the multi-laning of this primary north-south corridor in east Georgia, serving as a catalyst for development of this region. The improvements will aid the economic development of sparsely populated rural areas and small towns along this route. Eliminating the access rights to these parcels limits the ability to develop said parcels along the corridor, which hinders the achievement of the Need and Purpose of the project.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 433,798**	¾	**$ 433,798**
ALTERNATIVE	**$ 0**	¾	**$ 0**
SAVINGS	**$ 433,798**	¾	**$ 433,798**

CALCULATIONS

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 9

DESCRIPTION: ELIMINATE LIMITED ACCESS TO FURTHER PROMOTE DEVELOPMENT COST ESTIMATE.

SHEET NO.: 2 of 3

THE PROPOSED DESIGN CALLS FOR SR17 TO BE RELOCATED ONTO NEW LOCATION FOR APPROXIMATELY 4.3 MILES OF THE PROJECT. THE PORTION OF THE PROJECT ON NEW LOCATION IS PROPOSED TO BE LIMITED ACCESS. OUR ALTERNATIVE CALLS FOR THE RELOCATED ROAD ON NEW LOCATION TO BE CONTROLLED ACCESS ELIMINATING THE LIMITED ACCESS. THE ROAD GEOMETRY AND PLAN MAY REMAIN AS DESIGNED. ELIMINATING THE LIMITED ACCESS WILL ONLY RESULT IN THE REMOVAL OF THE LIMITED ACCESS FENCE, AND ELIMINATE THE ACQUISITION OF THE ACCESS RIGHTS FROM PROPERTY OWNERS ALONG THE RELOCATION.

DETERMING COST OF LIMITED ACCESS FENCE

- WOVEN WIRE FENCING WILL NOT BE REQUIRED ALONG BOTH SIDES OF THE ROADWAY

REDUCE WOVEN WIRE FENCE

$$\text{LENGTH} = 4.3 \text{ MILES} \times \frac{5280 \text{ FT}}{\text{MILE}} \times 2 \text{ SIDES}$$

$$= 45500 \text{ FT} \times \$3.56 \text{ /FT} = \$161,980$$

DETERMINE COST OF PURCHASING ACCESS RIGHTS

$$\text{LENGTH} = 45500 \text{ FT} \times \$5.00 \text{ /FT} = \$227500$$

NOTE: THE PRICE PER FOOT OF ACCESS RIGHTS IS AN ESTIMATE. AND AT THE TIME OF THE STUDY, A VALUE FOR ACCESS RIGHTS COULD NOT BE VERIFIED BY GDOT R/W STAFF. SHOULD THIS ALTERNATE BE IMPLEMENTED, THE COSTS FOR PURCHASING ACCESS RIGHTS SHOULD BE REVIEWED TO DETERMINE IF IT IS FEASIBLE.

COST WORKSHEET

PROJECT: **EDS-545(53), PI NO. 222255**
WIDENING SR 17 / US 78 FROM SR 6 / SMITH HILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties

ALTERNATIVE NO: 9

DESCRIPTION

SHEET NO. 3 of 3

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Purchase of Access Rights	LF	45,500	5.00	227,500			
Woven wire fence for limited access	LF	45,500	3.56	161,980			
Construction Mark-Up @ 27.34%	%		27.36%	44,318			
Construction Subtotal				206,298			
	Sub-total			433,798			
Mark-up at				INCL			
	TOTAL			433,798			

VALUE ENGINEERING ALTERNATIVE

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17/US 78 FROM SR 6/SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 10

DESCRIPTION: **SIMPLIFY THE BELLWOOD ROAD INTERSECTION WITH THE WIDENED SR 17/US 78 AT THE NORTH END OF PROJECT**

ORIGINAL DESIGN:

The current design of the new location of the SR 17/US 78 widening project accesses Bellwood Road with two intersections and an additional intersection appears just south of the southern most Bellwood Road intersection. Therefore, three intersections access the widened SR 17/US 78 in close proximity at the north end of the project.

ALTERNATIVE: (Sketch attached)

The alignment of Bellwood Road between existing SR 17/US 78 and the proposed new alignment of SR 17/US 78 can be improved and simplified to eliminate at least one of the three intersections within close proximity to each other and the large radius curve.

ADVANTAGES:

- Eliminates at least one intersection
- Improves safety
- Improves traffic operation
- Stays further away from cemetery
- Increases distance from historic property
- Helps preserve historic property

DISADVANTAGES:

- One of the three options places an intersection in the middle of a curve
- Reduces the number of access points
- Creates slight inconvenience to users
- Potentially limits development

DISCUSSION:

This alternative presents three options that can be further evaluated during the preliminary design and plan preparation stage of the project.

Option 1 realigns Bellwood Road with the local road to the east into one intersection with Reynolds Road that ties into relocated Bellwood Road. A minor drawback to this scheme is the alignment of the new crossroad which would be slightly skewed but with less than 80°. The major benefit of this option is the consolidation and elimination of an intersection.

Option 2 maintains Bellwood Road as the major movement and allows the crossroad to tie into Bellwood Road. This provides an additional intersection within a horizontal curve area. However, it appears there is a small side road to the east that is to be maintained. If this is the situation, it would be desirable to combine the intersections. The horizontal sight distance would still be adequate for the 65 mph design speed. This option could potentially require one or two displacements.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE	DESIGN SUGGESTION		
SAVINGS			

VALUE ENGINEERING ALTERNATIVE

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17/US 78 FROM SR 6/SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 10

DESCRIPTION: **SIMPLIFY THE BELLWOOD ROAD INTERSECTION WITH THE WIDENED SR 17/US 78 AT THE NORTH END OF PROJECT**

DISCUSSION Continued:

Option 3 ties Bellwood Road and Reynolds Road into one street with a curved alignment providing access to SR 17/US 78 via a short roadway as a T-intersection. This option eliminates the potential of any displacements.

The benefit of optimizing the Bellwood Road alignment is not a matter of cost savings; all options are relatively comparable from a cost and right-of-way perspective—other than the possible displacements noted in Option 2, is improved operations, controlled access, and elimination of local road crossings/intersections.

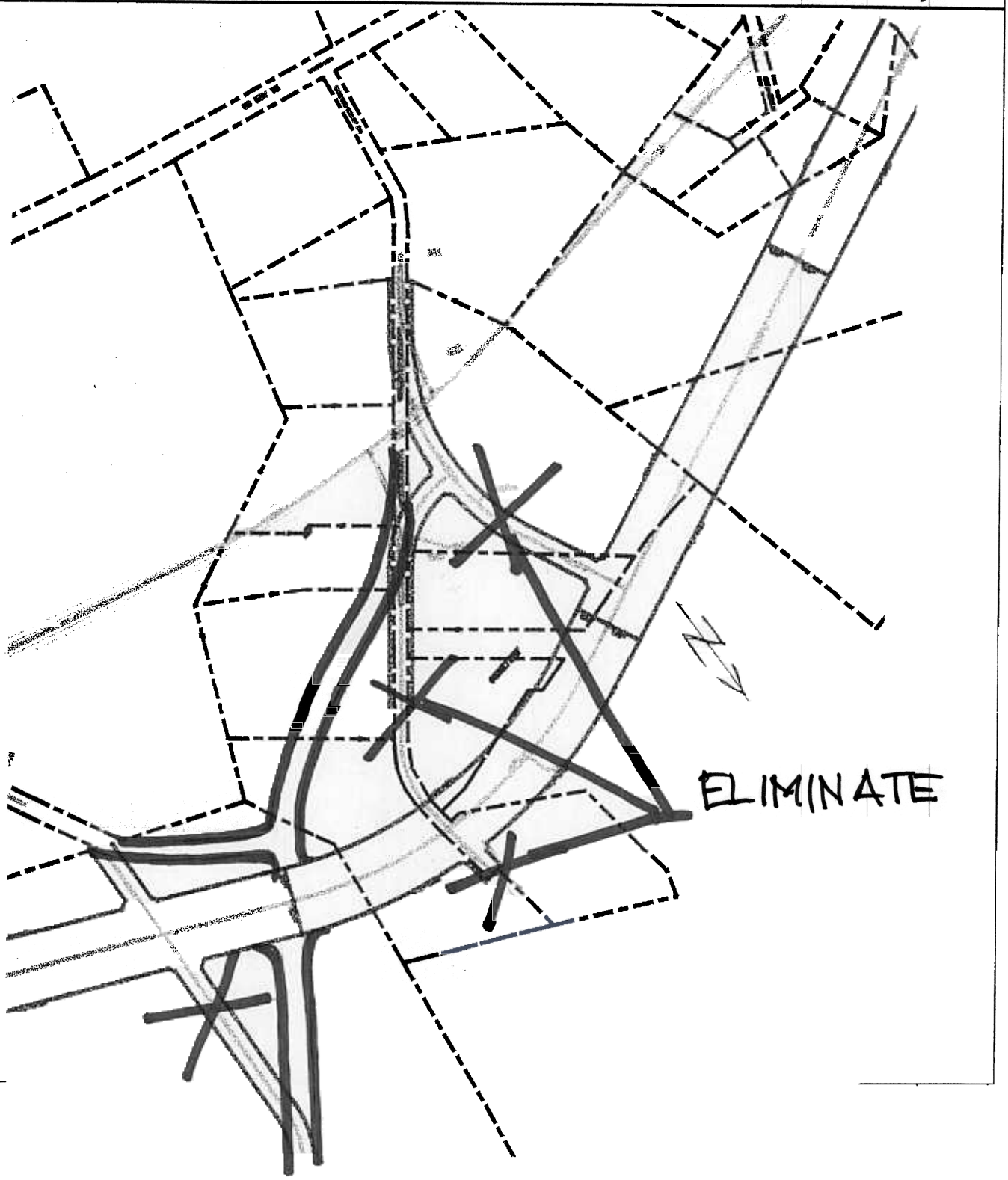
SKETCHES

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 10 OPTION 1

☐ AS DESIGNED ☑ ALTERNATIVE

SHEET NO.: 3 of 5



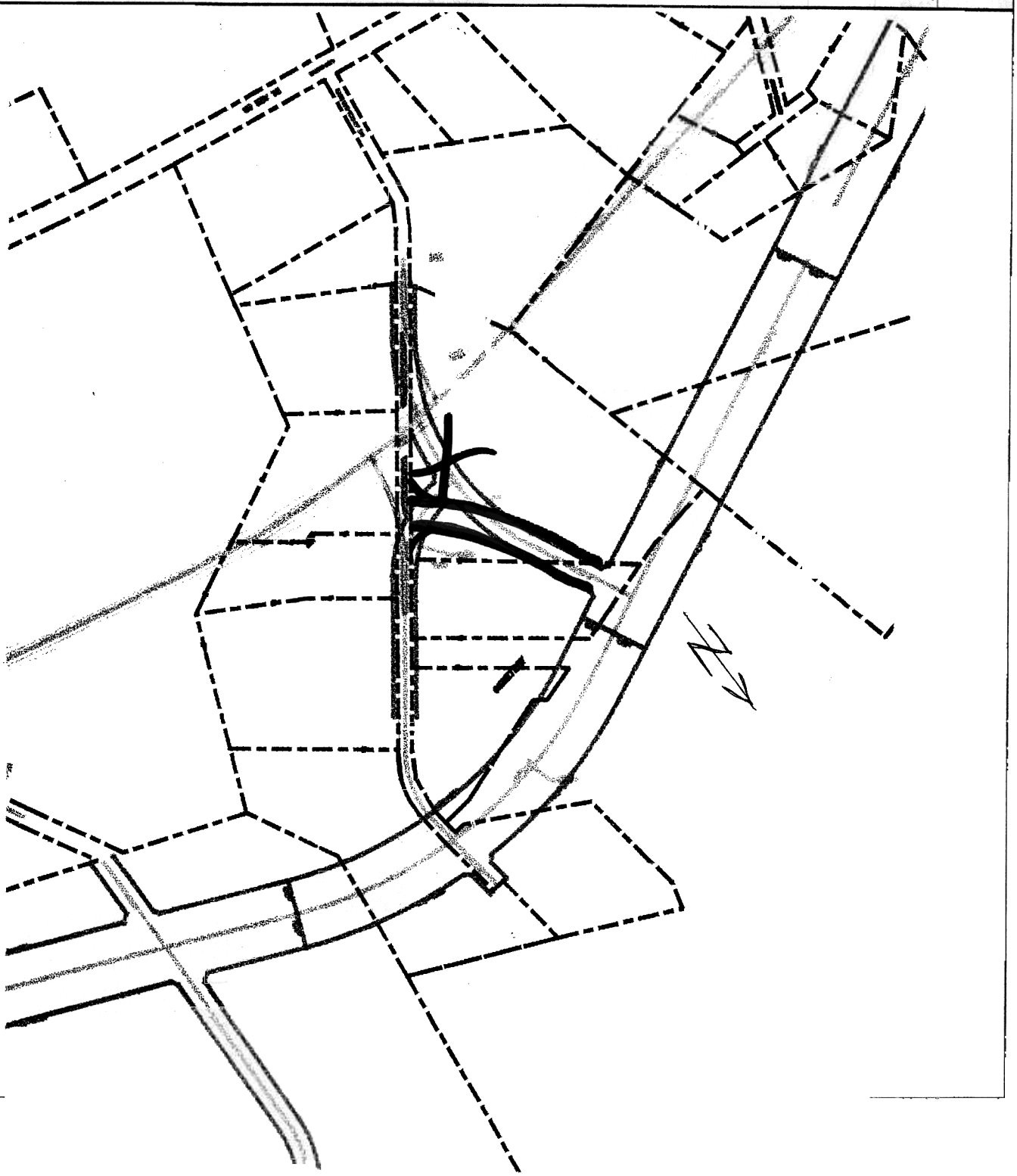
SKETCHES

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 10 OPTION 2

☐ AS DESIGNED ☑ ALTERNATIVE

SHEET NO.: 4 of 5



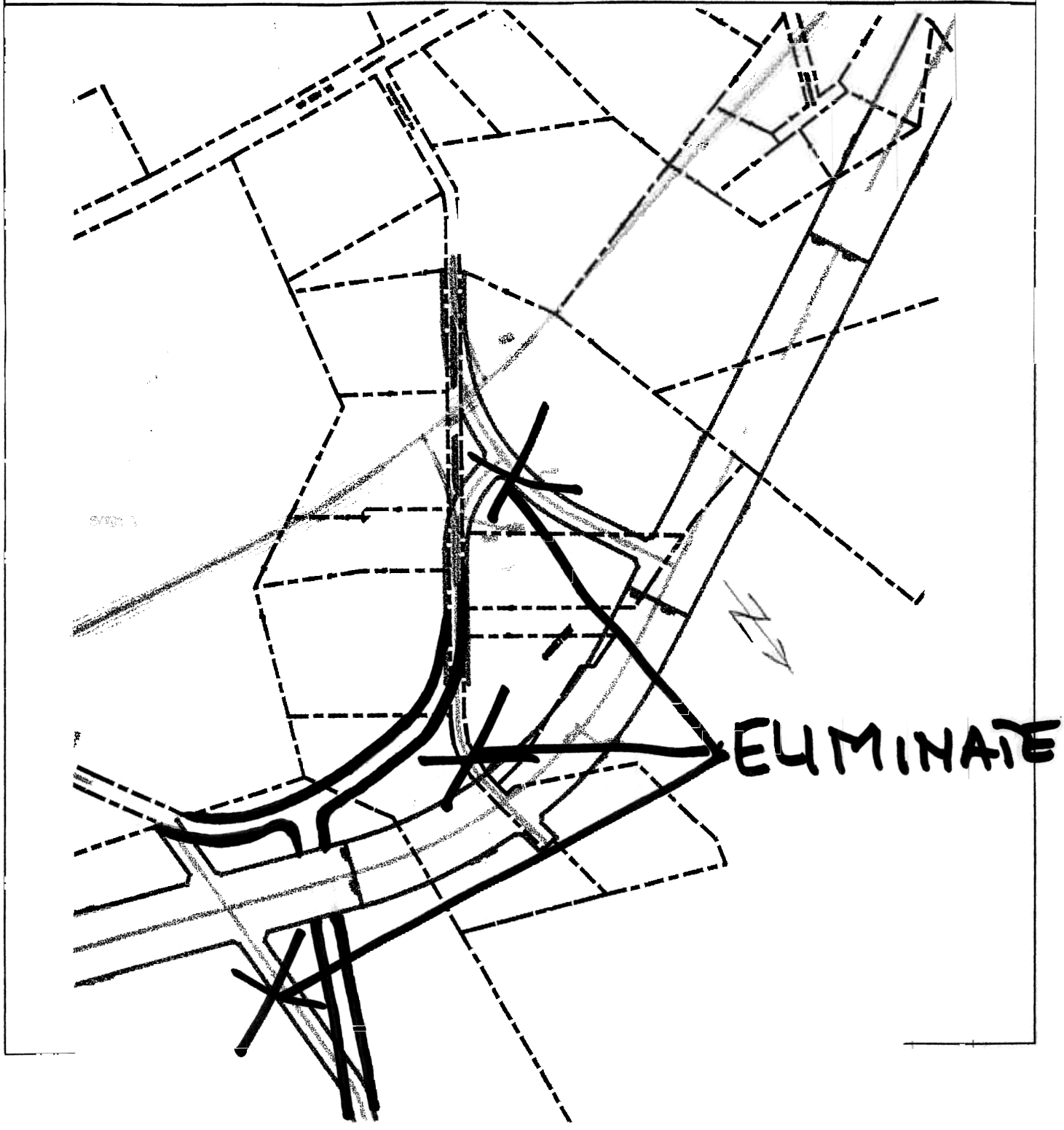
SKETCHES

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 10
OPTION 3

☐ AS DESIGNED ☑ ALTERNATIVE

SHEET NO.: 5 of 5



VALUE ENGINEERING ALTERNATIVE

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17/US 78 FROM SR 6/SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 11/12

DESCRIPTION: **MODIFY THE ALIGNMENT AT THE NORTH END OF THE PROJECT**

ORIGINAL DESIGN:

The current design calls for the north terminus of the project to merge into the southern end of the Washington Bypass.

ALTERNATIVE: (Sketch attached)

Revise/optimize the horizontal alignment at the north terminus of the project by avoiding the existing subdivision and the large historic parcel abutting the Washington Bypass. The realignment would tie into the Washington Bypass further north.

Roadway costs are not significantly different between alternatives.

ADVANTAGES:

- Eliminates some displacements
- Eliminates "broken back" curve
- Improves safety
- Improves traffic operation
- Avoids the existing subdivision

DISADVANTAGES:

- Creates a tight fit
- May not provide sufficient room to make the appropriate connection to the Washington Bypass
- Possibly encroaches into the historic property

DISCUSSION:

This alternative provides a revised horizontal alignment that traverses a more open right-of-way and eliminates impacts to the existing/developing subdivision at Upton Mill Road. Even though this alignment will require some displacements, there should be a net reduction of up to three residences and those taken should be less costly than newly constructed residences as currently proposed.

The challenge is to develop an acceptable alignment for a design speed of 65 miles per hour (mph) while not affecting the large historic property(ies). This alignment introduces a tighter reverse curve. However, there should be ample room to develop an acceptable design that incorporates superelevation run out.

Additional study elements to this alternative would be:

(1) Reduce the design speed to 55 mph approaching the existing five lane section that already has lower speed limits. This would provide more flexibility to develop an acceptable alignment.

(2) Continue the use of a five lane section throughout this segment/area of the project for fewer right-of-way impacts and reduce the design speed.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 900,000**	¾	**$ 900,000**
ALTERNATIVE	**$ 0**	¾	**$ 0**
SAVINGS	**$ 900,000**	¾	**$ 900,000**

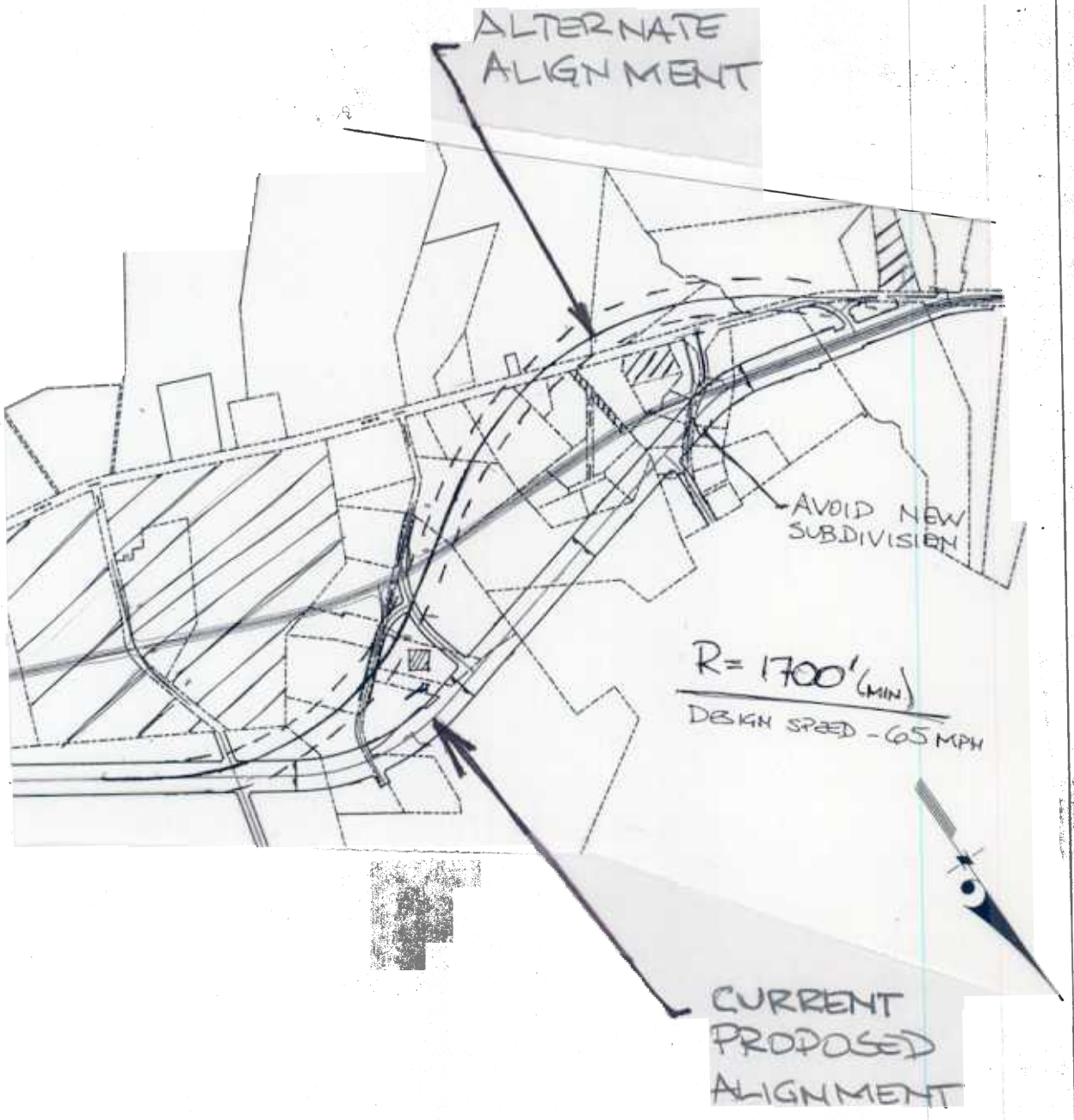
SKETCHES

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 11/12

☐ AS DESIGNED ☒ ALTERNATIVE

SHEET NO.: 2 of 4



CALCULATIONS

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 11/12

DESCRIPTION:

SHEET NO.: 3 of 4

NET SAVINGS OF 3 FEWER DISPLACEMENTS / R/W ACQUISITION

ASSUME EACH @ $300,000

COST WORKSHEET

PROJECT: **EDS-545(53), PI NO. 222255**
WIDENING SR 17/US 78 FROM SR 6/SMITH HILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties

ALTERNATIVE NO: 11/12

DESCRIPTION

SHEET NO. 4 of 4

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
ROW Acquisition Displacement	EA	3	300,000	900,000			
Sub-total				900,000			
Mark-up at				N/A			
TOTAL				900,000			

VALUE ENGINEERING ALTERNATIVE

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17/US 78 FROM SR 6/SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 13

DESCRIPTION: **USE ONE-WAY PAIR AT NORTH END OF PROJECT**

ORIGINAL DESIGN:

The original design calls for the widening of SR 17/US 78 from CR 6 to the Washington Bypass. From CR 6 to Big Cedar Road, the existing pavement is widened and access is maintained with the current configuration. From Big Cedar Road to the Washington Bypass, the road is relocated to new location and becomes limited access.

ALTERNATIVE: (Sketch attached)

Create a one-pair at the north end of the project with the southbound lanes on the existing SR 17/US 78 alignment and the northbound lanes on the new location alignment. Commencement of the one-way pair would be at the treatment plant and finalizes at the north terminus – the Washington Bypass.

ADVANTAGES:

- Saves initial cost
- Improves access control
- Improves overall safety
- Reduces disruption to local residents
- Uses existing roadway
- Maintains historic preservation

DISADVANTAGES:

- Some access difficulties
- Creates an atypical G.R.I.P. section

DISCUSSION:

The principal benefit, in addition to the significant cost savings, is taking advantage of the existing facility as the southbound roadway and reducing in half the work, right-of-way width, and elimination of some displacements of the SR 17/US 78 new location. The new location would serve as the northbound roadway. Although there will be operational and potential safety issues with a one-way pair configuration, they can be overcome with additional signage and driver awareness. In addition to the existing roadway, Reynolds and Bellwood Roads will provide easy access.

It is noted this alternative could also be studied with an alignment to the west rather than the east if this location proves to be less cumbersome and problematic from an historic properties perspective.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 3,253,219**	¾	**$ 3,253,219**
ALTERNATIVE	**$ 191,040**	¾	**$ 191,040**
SAVINGS	**$ 3,062,179**	¾	**$ 3,062,179**

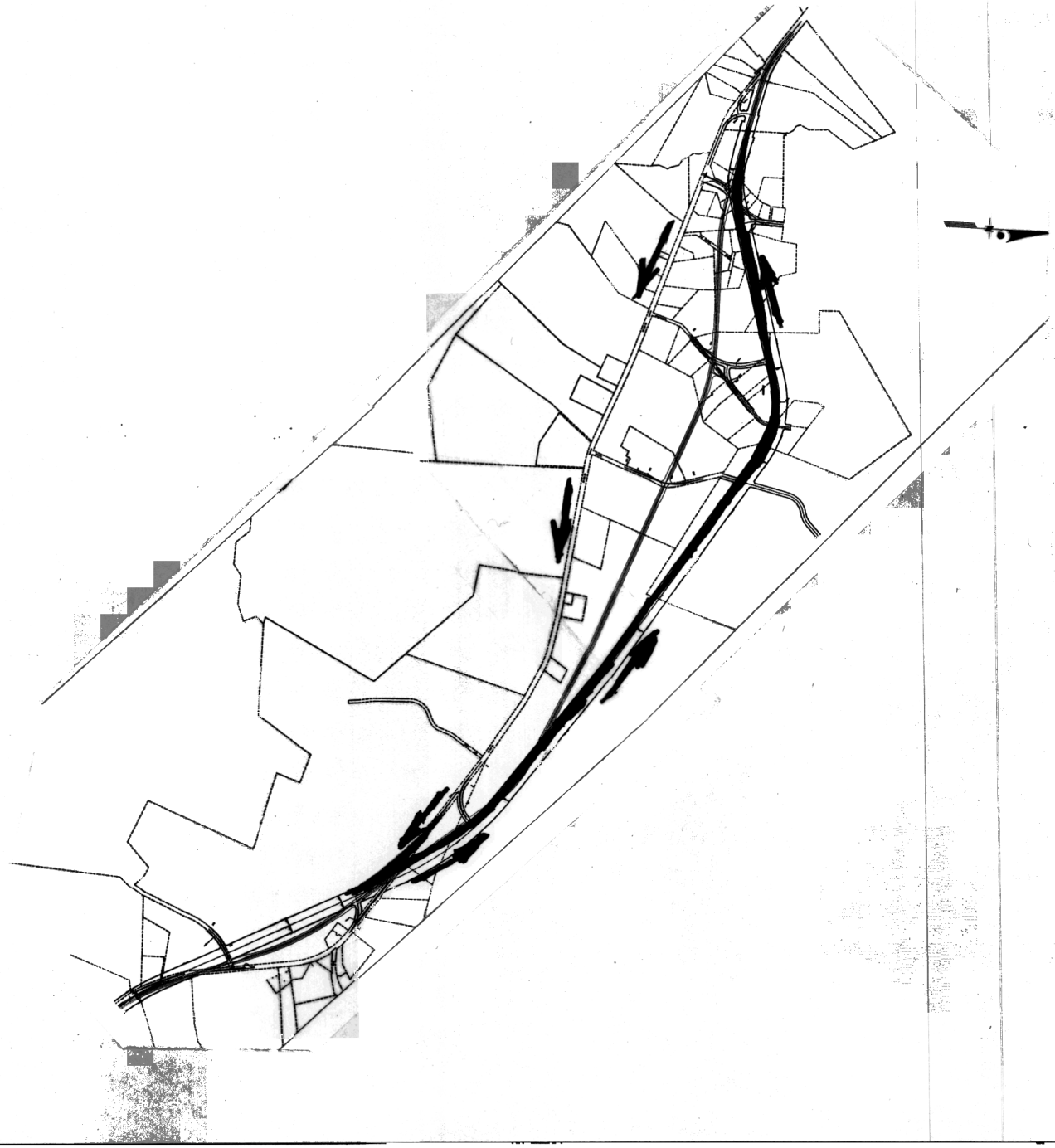
SKETCHES

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 13

☐ AS DESIGNED ☑ ALTERNATIVE

SHEET NO.: 2 of 4



CALCULATIONS

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 13

DESCRIPTION:

SHEET NO.: 3 of 4

TOTAL LENGTH OF ONE WAY PAIR - 20,000 LF

RIGHT OF WAY

ASSUME HALF - TOTAL 300 FEET WIDE
USE 150

20,000 (150) = 3,000,000 ft² - 68.9 ACRES
USE 70 ACRES

ROADWAY

20,000 ft (30 ft WIDE) = 600,000 ft² = 66,700 yd²

USE A COST OF 35 $/SY. FOR PAVEMENT COST INCLUDING EARTHWORK / GAB & ASPHALT

COST WORKSHEET

PROJECT: **EDS-545(53), PI NO. 222255**
WIDENING SR 17 / US 78 FROM SR 6 / SMITH HILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties

ALTERNATIVE NO: 13

DESCRIPTION

SHEET NO. 4 of 4

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Right-of-Way	AC	70	4,000.00	280,000			
Pavement	SY	66,700	35.00	2,334,500			
Construction Mark-Up @ 27.34%	%		27.36%	638,719			
Construction Subtotal				2,973,219			
Additional Signage	LS				1		150,000
Construction Mark-Up @ 27.34%	%					27.36%	41,040
Construction Subtotal							191,040
	Sub-total			3,253,219			191,040
Mark-up at				INCL			INCL
	TOTAL			3,253,219			191,040

VALUE ENGINEERING ALTERNATIVE

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17/US 78 FROM SR 6/SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 14

DESCRIPTION: **RECONFIGURE THE NEW ROADWAY FROM THE WILLIAMS LEVERETT HOUSE TO THE WASHINGTON BYPASS**

ORIGINAL DESIGN: (Sketch attached)

The original design calls for the realignment of SR 17/US 78 on the new location from the Williams Leverett House to the Washington Bypass. The typical section is a four-lane section with a 44-ft. depressed median and rural shoulders with an open channel ditch drainage system. The minimum right-of-way (ROW) through this section is 300 ft. wide.

ALTERNATIVE: (Sketch attached)

Retain the alignment on the existing location from the Williams Leverett House to the Washington Bypass but change the typical section to four lanes with a 20-ft. raised median and urban shoulder treatments with curb and gutter, sidewalks, and a closed drainage system. The minimum ROW through this section would be 100 feet wide which is the existing ROW width. Some additional ROW may be necessary for turning lanes.

ADVANTAGES:

- Saves initial cost
- Fits roadway within existing ROW
- Urban section encourages development
- Continues corridor while minimizing impacts
- Creates no displacements
- Provides greater potential for public acceptance
- Reduces project length

DISADVANTAGES:

- Creates a design speed not consistent with G.R.I.P.
- Requires lower speed limits with this type of section

DISCUSSION:

Several historic properties along the existing location require the alignment to shift significantly outside the existing roadway because the proposed typical section cannot fit within the existing ROW. Revising the typical section to fit within the ROW could eliminate historic impact and reduce ROW costs – including five displacements – while maintaining the four-lane corridor connection to Washington.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 20,974,699**	¾	**$ 20,974,699**
ALTERNATIVE	**$ 19,193,376**	¾	**$ 19,193,376**
SAVINGS	**$ 1,781,323**	¾	**$ 1,781,323**

SKETCHES

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 14

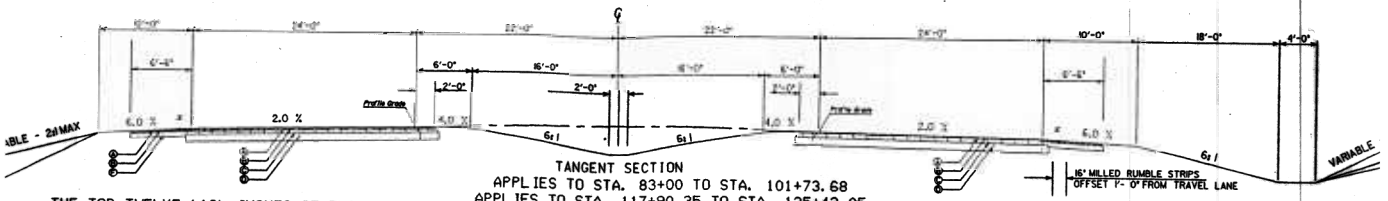
☒ AS DESIGNED ☐ ALTERNATIVE

SHEET NO.: 2 of 11

ORIGINAL TYPICAL SECTION FROM WILLIAMS LEVERETT HOUSE TO END OF PROJECT - MINIMUM RIGHT-OF-WAY WIDTH = 300 FT.

TYPICAL SECTIONS

TS-3
4 LANE WITH 44 FT MEDIAN, NEW LOCATION

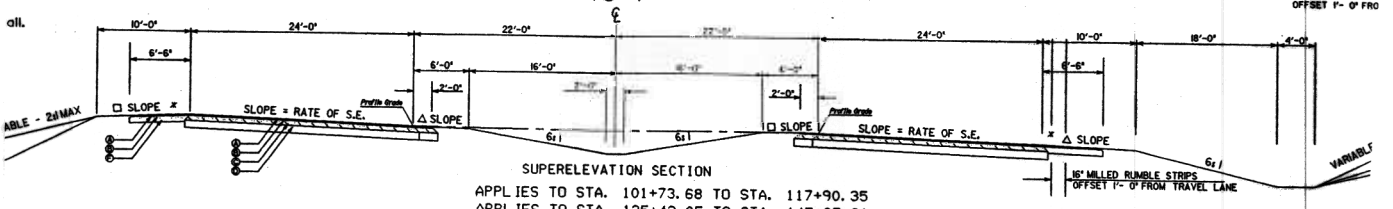


THE TOP TWELVE (12) INCHES OF THE SUBGRADE SHALL BE CLASS I OR II.

TANGENT SECTION

APPLIES TO STA. 83+00 TO STA. 101+73.68
APPLIES TO STA. 117+90.35 TO STA. 125+42.05
APPLIES TO STA. 145+37.61 TO STA. 176+80.84
APPLIES TO STA. 195+75.98 TO STA. 227+32.28
APPLIES TO STA. 259+47.58 TO STA. 275+80.37
APPLIES TO STA. 294+74.70 TO STA. 309+55.60
APPLIES TO STA. 331+73.57 TO STA. 364+20.52
APPLIES TO STA. 382+53.80 TO STA. 453+61.94
APPLIES TO STA. 475+48.72 TO STA. 489+01.99
APPLIES TO STA. 502+35.22 TO STA. 522+25.09

TS-4



SUPERELEVATION SECTION

APPLIES TO STA. 101+73.68 TO STA. 117+90.35
APPLIES TO STA. 125+42.05 TO STA. 145+37.61
APPLIES TO STA. 176+80.84 TO STA. 195+75.98
APPLIES TO STA. 227+32.28 TO STA. 259+47.58
APPLIES TO STA. 275+80.37 TO STA. 294+74.70
APPLIES TO STA. 309+55.60 TO STA. 331+73.57
APPLIES TO STA. 364+20.52 TO STA. 382+53.80
APPLIES TO STA. 453+61.94 TO STA. 475+48.72
APPLIES TO STA. 489+01.99 TO STA. 502+32.22

△ SLOPE 3/4" / 1'-0" OR RATE OF S.E. WH

□ SLOPE AS FOLLOWS:
S.E. RATE OF 0.03'/FT OR LESS USE 1/2'

SKETCHES

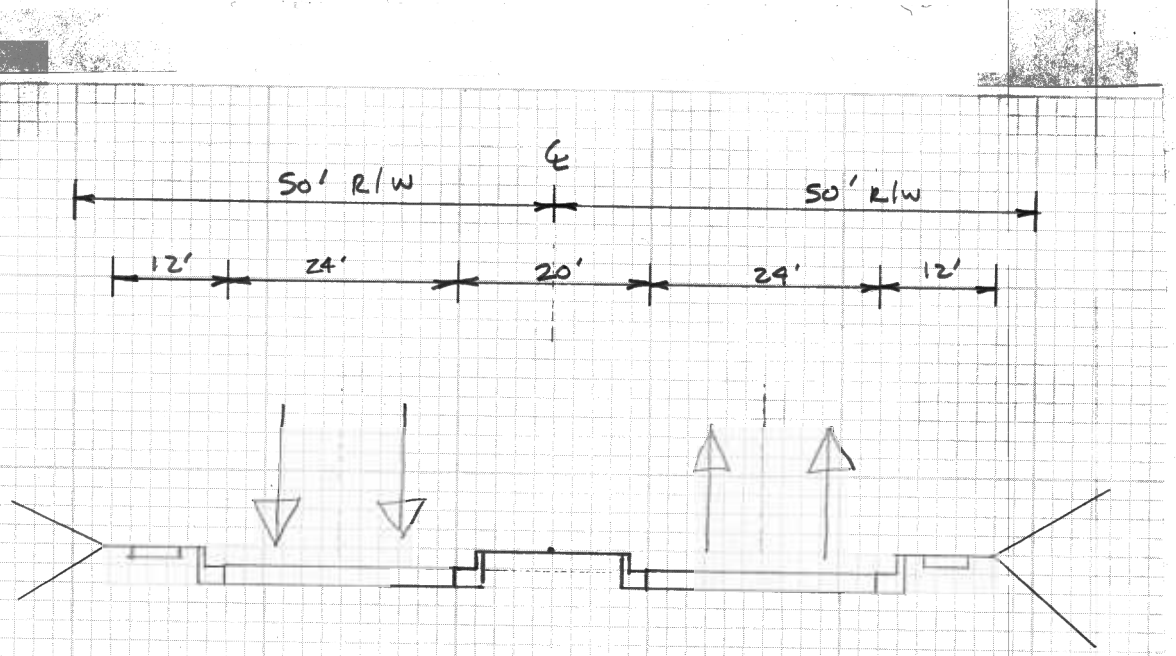
PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 14

☐ AS DESIGNED ☒ ALTERNATIVE

SHEET NO.: 3 of 11

PROPOSED TYPICAL SECTION FROM WILLIAMS LEVERETT HOUSE TO END OF PROJECT - MINIMUM RIGHT-OF-WAY WIDTH = 100 FT.



CALCULATIONS

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 14

DESCRIPTION: REDUCE DESIGN SPEED, CHANGE TYPICAL AND REMAIN ON EXISTING LOCATION - WILLIAM LEVERETT HOUSE TO END OF PROJECT
COST ESTIMATE

SHEET NO.: 4 of 11

ALONG PROPOSED ALIGNMENT, FROM WILLIAMS LEVERETT HOUSE TO END OF PROJECT IS APPROXIMATELY 4.1 MILES OR 43% OF PROPOSED ALIGNMENT ALONG EXISTING LOCATION, FROM WILLIAMS LEVERETT HOUSE TO END OF PROJECT IS APPROXIMATELY 3.6 MILES

RIGHT OF WAY COSTS -

- LAND COSTS - PROPOSED ALIGNMENT - 43% OF ORIGINAL LAND COSTS
  = 43% x $1,741,000 = $750,000

LAND COSTS - ALONG EXISTING LOCATION - PROPOSED ALTERNATE TYPICAL SECTION WILL FIT WITHIN EXISTING ROW, HOWEVER LAND WILL BE REQUIRED IN AREAS WHERE THE ALIGNMENT IS SHIFTED TO AVOID HISTORIC RESOURCES, FOR TURN LANES OR OTHER REASONS

LAND UNIT COST - 5.4 MILES @ 200' (300' - 100' EXIST) = 131 ACRES
4.1 MILES @ 300' (NEW LOCATION) = 149 ACRES

TOTAL PROP R/W REQD = 280 ACRES

LAND ESTIMATED R/W COST = $1741000 / 280 ACRES
= $6218 /AC.

ALONG EXISTING LOCATION - ASSUME 10' STRIP REQUIRED ALONG EXIST LOCATION TO FACILITATE ALIGNMENT SHIFTS

LAND COST - 3.6 MILES @ 10' = 5 ACRES

LAND ESTIMATED R/W COST = $6218/AC x 5 AC
= $32000

CALCULATIONS

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 14

DESCRIPTION: REDUCE DESIGN SPEED, CHANGE TYPICAL & REMAIN ON EXISTING LOCATION WILLIAM LEVERETT HOUSE TO END OF PROJECT
COST ESTIMATE

SHEET NO.: 5 of 11

RIGHT-OF-WAY COST (CON'T)

- DISPLACEMENTS
  - PROPOSED ALIGNMENT (5 DISPLACEMENTS) - $592,000*
    * NOTE - FROM COST ESTIMATE - THIS FIGURE APPEARS LOW
  - ALONG EXISTING LOCATION (0 DISPLACEMENTS) - $0
- OTHER COSTS (ADM, INFLATION) - ASSUME THIS IS A FUNCTION OF TOTAL RW COSTS.
  - ORIGINAL ESTIMATE - PROPERTY - $1 741 000
    DISPLACEMENTS - $592 000
    $2333 000
    OTHER COSTS - $1895000
    RATIO : 81 %
  - PROPOSED ALIGNMENT PROPERTY - $750 000
    DISPLACEMENTS - $592,000
    $1342,000
    OTHER COSTS = 81% x 1342 000
    = $1,087,000
  - EXISTING LOCATION PROPERTY - $32000
    DISPLACEMENTS - $0
    $32000
    OTHER COSTS = 81% x 32000
    = $26 000

CALCULATIONS

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 14

DESCRIPTION: REDUCE DESIGN SPEED, CHANGE TYPICAL, AND REMAIN ON EXISTING LOCATION - WILLIAM LEVERETT HOUSE TO END OF PROJECT. COST ESTIMATE

SHEET NO.: 6 of 11

RIGHT OF WAY SUMMARY

ORIGINAL ESTIMATE $1,741,000 - PROPERTY
$ 592 000 - DISPLACEMENTS
$ 1895000 - OTHER

ALTERNATIVE - PROPERTY - $1741000 - $750 000 + $32000 = $1023000
DISPLACEMENTS - $592000 - $592000 + $0 = $ 0
OTHER - $1895000 - $1087000 + $26000 = $834000

CONSTRUCTION COSTS

- ROADWAY PAVEMENT

PROPOSED ALIGNMENT - 4.1 MILES
EXISTING LOCATION - 3.6 MILES
APPROXIMATE REDUCTION IN LENGTH = 0.5 MILES
AREA OF PAVEMENT REDUCTION - 0.5 MILES x 5280 FT/MI x 48' x $\frac{1\ SY}{9\ SF}$
= 14100 SY PAVEMENT REDUCTION

PAVEMENT SECTION - 165 #/SY 12.5mm; 220 #/SY 19 mm; 440 #/SY 25mm; 12" GAB

12.5mm = 165 #/SY x 14100 SY = 1164 TON x $36.61/TON = $42615
19 mm = 220 #/SY x 14100 SY = 1551 TON x $38.08/TON = $59062
25mm = 440 #/SY x 14100 SY = 3102 TON x $36.57/TON = $113440
GAB = 14100 SY x $\frac{1}{3}$ YD x 2 TON/CY = 9400 TON x $14.24/TON = $133856

- SHOULDER PAVEMENT

PROPOSED ALIGNMENT - 4.1 MILES OF PAVED SHOULDERS
EXISTING LOCATION - PAVED SHOULDERS NOT REQUIRED
REDUCTION - 4.1 MILES OF PAVED SHOULDERS.

INSIDE SHOULDERS - AREA REDUCED = 4.1 MILES x 5280 F/MI x (2+2) x $\frac{1\ SY}{9\ SF}$
= 9630 SY PAVEMENT REDUCTION

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 14

DESCRIPTION: REDUCE DESIGN SPEED, CHANGE TYPICAL AND REMAIN ON EXISTING LOCATION WILLIAM LEVERETT HOUSE TO END OF PROJECT. COST ESTIMATE

SHEET NO.: 7 of 11

PAVEMENT SECTION - 165#/SY 12.5mm ; 220#/SY 19mm ; 440#/SY 25mm ; 12" GAB

12.5mm - 165#/SY x 9630 SY = 795 TON x $36.61 = $29105
19 mm - 220#/SY x 9630 SY = 1060 TON x $38.08 = $40365
25mm = 440#/SY x 9630 SY = 2120 TON x $36.57 = $77529
GAB - 9630 SY x 1/3 Y x 2 TON/CY = 6240 TON x $14.24 = $88858

OUTSIDE SHOULDERS

PROPOSED ALIGNMENT - 4.1 MILES OF PAVED SHOULDERS
EXISTING LOCATION - PAVED SHOULDERS NOT REQUIRED
REDUCTION - 4.1 MILES OF PAVED SHOULDERS

OUTSIDE SHOULDERS - AREA REMOVED = 4.1 MILES x 5280 FT/MI x (6.5+6.5) x 1 SY/9 SF
= 31270 SY

PAVEMENT SECTION - 165#/SY 12.5mm ; 220#/SY 19mm ; 6" GAB

12.5mm - 165#/SY x 31270 SY = 2580 TON x $36.61 = $94454
19 mm - 220#/SY x 31270 SY = 3440 TON x $38.08 = $130996
GAB - 31270 SY x 0.5 FT/3 YD x 2 TON/CY = 10424 TON x $14.24 = $148438

- CURB & GUTTER

PROPOSED ALIGNMENT - NOT REQUIRED
EXISTING LOCATION - 3.6 MILES x 4 = 76,000 LF → 38000 LF TP 2, 38000 LF TP 7
ADDITION - TP 2 - 38000 x $12.93 = $ 491340
TP 7 = 38000 x $9.05 = $ 343900 TOTAL = $835240

- SIDEWALK

PROPOSED ALIGNMENT - NOT REQUIRED
EXISTING LOCATION - 3.6 MILES x 5280 FT/MI x 2 x 5 FT x 1 SY/9 SF = 21120 SY
ADDITION - 21120 SY SIDEWALK x $27.86 = $588403

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 14

DESCRIPTION: REDUCE DESIGN SPEED, CHANGE TYPICAL & REMAIN ON EXISTING LOCATION WILLIAM LEVERETT HOUSE TO END OF PROJECT. COST ESTIMATE

SHEET NO.: 8 of 11

- DRAINAGE - CLOSED DRAINAGE SYSTEM

  PROPOSED ALIGNMENT - NOT REQUIRED

  EXISTING LOCATION - 3.6 MILES = 19000 LF

  PIPE - ASSUME REQUIRED PIPE LENGTH = 1.75 x LENGTH
  = 1.75 x 19000 LF
  = 33250 LF

  ASSUME SPLIT 65% - 18"; 25% - 24"; 10% 30"

  ADDITION - 18" PIPE = 65% x 33250 = 21610 LF x $25.26 = $545869
  24" PIPE = 25% x 33250 = 8310 LF x $29.28 = $243317
  30" PIPE = 10% x 33250 = 3330 LF x $35.94 = $119681

  STRUCTURES - ASSUME 2 CATCH BASINS REQUIRED EVERY 150 LF

  ADDITION - CB - 19000 LF / 150 LF x 2
  = 250 CB x $1832.92 = $458230

- DRAINAGE - MEDIAN DRAINS

  PROPOSED ALIGNMENT - 4.1 MILES OF MEDIAN DRAINS

  EXISTING LOCATION - MEDIAN DRAINAGE INCLUDED IN CLOSED SYSTEM

  ASSUME - MEDIAN DRAINS LOCATED EVERY 300'; REQUIRED - 80 LF 18" PIPE, 1 9031-S DROP INLET; 10.5 SF SAFETY GRATE; 1.07 CY CLASS A CONC; 75 REBAR

  4.1 MILES x 5280 LF/mi = 21648 LF / 300 = 72 MEDIAN DRAINS

  REDUCE - 18" PIPE - 72 x 80 LF = 5760 EF x $25.26 = $145498
  DROP INLET - 72 EA. = 72 EA x $1464.79 = $105465
  SAFETY GRATE - 72 x 10.5 = 756 SF x $19.80 = $14969
  CLASS A CONC - 72 x 107 = 77 CY x $377.27 = $29050
  REBAR - 72 x 75 = 5400 LB x $0.52 = $2808

CALCULATIONS

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 14

DESCRIPTION: REDUCE DESIGN SPEED, CHANGE TYPICAL & REMAIN ON EXISTING LOCATION - WILLIAM LEVERETT HOUSE TO END OF PROJECT
COST ESTIMATE

SHEET NO.: 9 of 11

CONSTRUCTION SUMMARY

ORIGINAL ESTIMATE

12.5mm ASPH -	$1219589
19 mm ASPH -	$1651759
25 mm ASPH -	$2418411
GAB -	$3354332
CURB & GUTTER -	$0
SIDEWALK -	$0
18" PIPE -	$290794
24" PIPE -	$12444
30" PIPE -	$11070
CATCH BASIN -	$0
DROP INLET -	$200677
SAFETY GRATE -	$23206
CLASS A CONC -	$295780
REBAR -	$41158

ALTERNATE - ORIGINAL - REDUCTION + ADDITIONS.

12.5mm ASPH -	$1219589 - $42615 - $29105 - $94454 = $1053415
19 mm ASPH -	$1651759 - $59062 - $40365 - $130996 = $1421336
25mm ASPH -	$2418411 - $113440 - $77529 = $2227442
GAB -	$3354332 - $133856 - $88858 - $148438 = $2983180
CURB & GUTTER -	$0 - $0 + $835240 = $835240
SIDEWALK -	$0 - $0 + $588404 = $588404
18" PIPE -	$290794 - $145498 + $545869 = $691165
24" PIPE -	$12444 - $0 + $243317 = $255761
30" PIPE -	$11070 - $0 + $119681 = $130751
CATCH BASIN -	$0 - $0 + $456230 = $456230
DROP INLET -	$200677 - $105465 + $0 = $95212
SAFETY GRATE -	$23206 - $14969 + $0 = $8237
CLASS A CONC -	$295780 - $29050 + $0 = $266730
REBAR -	$411580 - $2808 + $0 = $408772

CALCULATIONS

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 14

DESCRIPTION: REDUCE DESIGN SPEED, CHANGE TYPICAL SECTION AND REMAIN ON EXISTING LOCATION - WILLIAMS LEVERETT HOUSE TO END OF PROJECT
COST ESTIMATE

SHEET NO.: 10 of 11

EARTHWORK ESTIMATE. ORIGINAL ESTIMATE PAYS FOR EARTHWORK AS A LUMP SUM COST. THE LUMP SUM COST IS $3,677,000. IT IS ASSUMED THAT THE EARTHWORK IS DISTRIBUTED EVENLY THROUGHOUT THE PROJECT. THEREFORE, SINCE 43% OF THE ALIGNMENT WOULD BE MOVED TO EXISTING LOCATION, THE EARTHWORK THROUGH THIS SECTION WOULD COST - 3677000 x 43% - $1,581,110. SINCE THE EXISTING LOCATION IS 0.5 MILES SHORTER THAN THE NEW LOCATION, THIS COST IS REDUCED TO $1,581,110 x $\frac{3.6}{4.1}$ = $1,388,290. FURTHERMORE, SINCE THE TYPICAL SECTION HAS BEEN REVISED, THIS COST CAN BE REDUCED FURTHER. THE NEW TYPICAL SECTION IS $\frac{1}{2}$ AS WIDE, DOES NOT CREATE A DITCH SECTION, AND IS ON EXISTING LOCATION, WHICH WILL NOT REQUIRE AS MUCH GRADING AS WOULD BE NEEDED THROUGH UNDISTURBED LAND. THEREFORE, IT IS ASSUMED THAT THE EARTHWORK AND GRADING REQUIRED ON EXISTING LOCATION WOULD BE $\frac{1}{3}$ OF THE COST REQUIRED ON NEW LOCATON WITH THE OLD TYPICAL SECTION. THEREFORE, THE COST IS REDUCED FURTHER TO $1,388,290 x $\frac{1}{3}$ = $462764

EARTHWORK SUMMARY

ORIGINAL = $3,677,000

ALTERNATE = $3,677,000 - $1,581,110 + $462764 = $2558654

COST WORKSHEET

PROJECT: **EDS-545(53), PI NO. 222255**
WIDENING SR 17 / US 78 FROM SR 6 / SMITH HILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties

ALTERNATIVE NO: 14

DESCRIPTION

SHEET NO. 11 of 11

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Right-of-Way:							
Property	LS	1		1,741,000			1,023,000
Displacements	LS	1		532,000			
Other Costs (Admin, Info, etc.)	LS	1		1,895,000			834,000
Right-of-Way Subtotal				4,168,000			1,857,000
Construction:							
12.5mm asphalt	TN	33,313	36.61	1,219,589	28,774	36.61	1,053,416
19.0mm asphalt	TN	43,376	38.08	1,651,758	37,325	38.08	1,421,336
25.0mm asphalt	TN	66,131	36.57	2,418,411	60,909	36.57	2,227,442
GAB	TN	235,557	14.24	3,354,332	209,493	14.24	2,983,180
Curb and Gutter - Type 2	LF				38,000	12.93	491,340
Curb and Gutter - Type 7	LF				38,000	9.05	343,900
Sidewalk	SY				21,120	27.86	588,403
18" Pipe	LF	11,512	25.26	290,793	27,362	25.26	691,164
24" Pipe	LF	425	29.28	12,444	8,735	29.28	255,761
30" Pipe	LF	308	35.94	11,070	3,638	35.94	130,750
Catch Basin	EA				250	1,832.92	458,230
Drop Inlet	EA	137	1,464.79	200,676	65	1,464.79	95,211
Safety Grate	SF	1,172	19.80	23,206	416	19.80	8,237
Class A Concrete	CY	784	377.27	295,780	707	377.27	266,730
Rebar	LB	79,149	0.52	41,157	73,749	0.52	38,349
Earthwork	LS	1		3,677,000	1		2,558,654
Construction Subtotal				13,196,215			13,612,104
Construction Mark-Up @ 27.34%	%		27.36%	3,610,484		27.36%	3,724,272
Construction Subtotal				16,806,699			17,336,376
Sub-total				20,974,699			19,193,376
Mark-up at				INCL			INCL
TOTAL				20,974,699			19,193,376

VALUE ENGINEERING ALTERNATIVE

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17/US 78 FROM SR 6/SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 15

DESCRIPTION: **SHIFT THE ALIGNMENT TO THE WEST**

ORIGINAL DESIGN: (Sketch attached)

The original design calls for the widening of SR 17/US 78 from CR 6 to the Washington Bypass. From CR 6 to Big Cedar Road, the existing pavement is widened and access is maintained with the current configuration. From Big Cedar Road to the Washington Bypass, the road is relocated to the east to a new location and provides limited access.

ALTERNATIVE: (Sketch attached)

Provide/develop a new western location for the widening of SR 17/US 78 using a portion of the existing alignment in lieu of the new eastern location.

ADVANTAGES:

- Minimizes right-of-way takes/displacements
- Improves access control
- Improves overall safety
- Disrupts local residents less
- Uses existing roadway

DISADVANTAGES:

- Historic properties may exist
- Squeezes the northern section

DISCUSSION:

This alternative is possible if the current mapping's data is correct that only two historic properties exist on the west side: one small one in the vicinity of the project's northern terminus which can be easily circumvented and another larger parcel across from the Lincoln Bounds House in the vicinity of ±STA 400. The larger parcel will require realignment to circumvent. However, for a significant portion of the alignment (about 8,000 ft.) this alternative can parallel the existing roadway and alignment. This will permit a reduction in the required right-of-way, eliminating some displacements and potentially using some of the existing roadway. This could contribute major cost savings to the project.

More detailed historic alignment studies would have to be conducted to completely evaluate this alternative.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 1,294,656**	¾	**$ 1,294,656**
ALTERNATIVE	**$ 0**	¾	**$ 0**
SAVINGS	**$ 1,294,656**	¾	**$ 1,294,656**

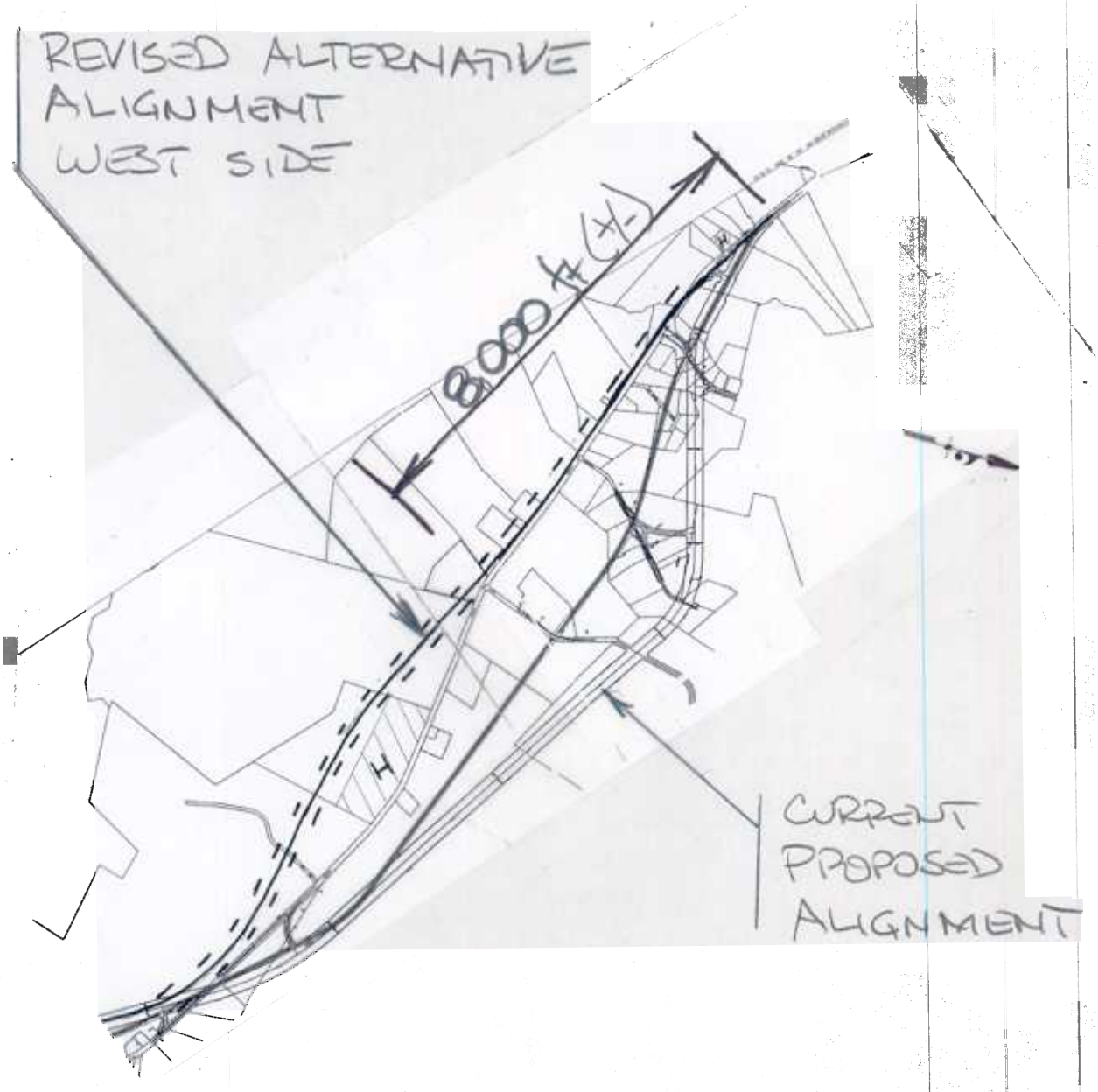
SKETCHES

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 15

☑ AS DESIGNED ☑ ALTERNATIVE

SHEET NO.: 2 of 4



CALCULATIONS

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 15

DESCRIPTION:

SHEET NO.: 3 of 4

TOTAL COST OF PROJECT $30,000,000

TOTAL LENGTH 50,500 LF

$= 594 \$/ft$

USE $600 \$/ft$

FROM REYNOLDS TO NORTHERN TERMINUS - ABOUT 8000 ft

R/W ⇒ 200 ADDITIONAL FEET IN LIEU OF 300 - SAVE 100 ft.

$8000 ft (100 ft) \frac{1}{43560} = 18.365$ ACRES

IN AREA WHERE WE WILL BE ALONG EXISTING ALIGNMENT - USE 20% REDUCTION IN CONSTRUCTION COSTS

$600 \$/LF (0.20) =$

$120 \$/LF$

COST WORKSHEET

PROJECT: **EDS-545(53), PI NO. 222255**
WIDENING SR 17 / US 78 FROM SR 6 / SMITH HILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties

ALTERNATIVE NO: 15

DESCRIPTION

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Right-of-Way	AC	18	4,000.00	72,000			
Roadway Costs (20% reduction)	LF	8,000	120.00	960,000			
Construction Mark-Up @ 27.34%	%		27.36%	262,656			
Construction Subtotal				1,222,656			
	Sub-total			1,294,656			
Mark-up at				INCL			
	TOTAL			1,294,656			

VALUE ENGINEERING ALTERNATIVE

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17/US 78 FROM SR 6/SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 16

DESCRIPTION: **PROJECT THE NEW LOCATION ALIGNMENT FURTHER NORTH TO A NEW NORTH TERMINUS**

ORIGINAL DESIGN: (Sketch attached)

The original design calls for the widening of SR 17/US 78 from CR 6 to the Washington Bypass. From CR 6 to Big Cedar Road, the existing pavement is widened and access is maintained with the current configuration. From Big Cedar Road to the Washington Bypass, the road is relocated to the east to a new location and becomes limited access.

ALTERNATIVE: (Sketch attached)

Project the proposed new location alignment further north to a new terminus on the Washington Bypass.

ADVANTAGES:

- Minimizes right-of-way takes/displacements
- Disrupts local residents less
- Avoids the existing subdivision

DISADVANTAGES:

- Creates additional limits
- Lengthens project
- Adds initial roadway costs
- Creates an unknown situation at proposed new northern terminus

DISCUSSION:

This alternative provides a revised alignment at the northern terminus of the project. The primary benefit is to bypass and eliminate the acquisition of several residences within a relatively new subdivision.

This alternative extends the project limit by about 3,500 ft. However, it would avoid the historic property abutting the Washington Bypass. The current mapping does not extend far enough to properly evaluate a specific alignment and tie-in point. A more in-depth study could yield a desirable tie-in point if local opposition with the current proposed alignment is excessive.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 2,500,000**	¾	**$ 2,500,000**
ALTERNATIVE	**$ 2,674,560**	¾	**$ 2,674,560**
SAVINGS	**$ (174,560)**	¾	**$ (174,560)**

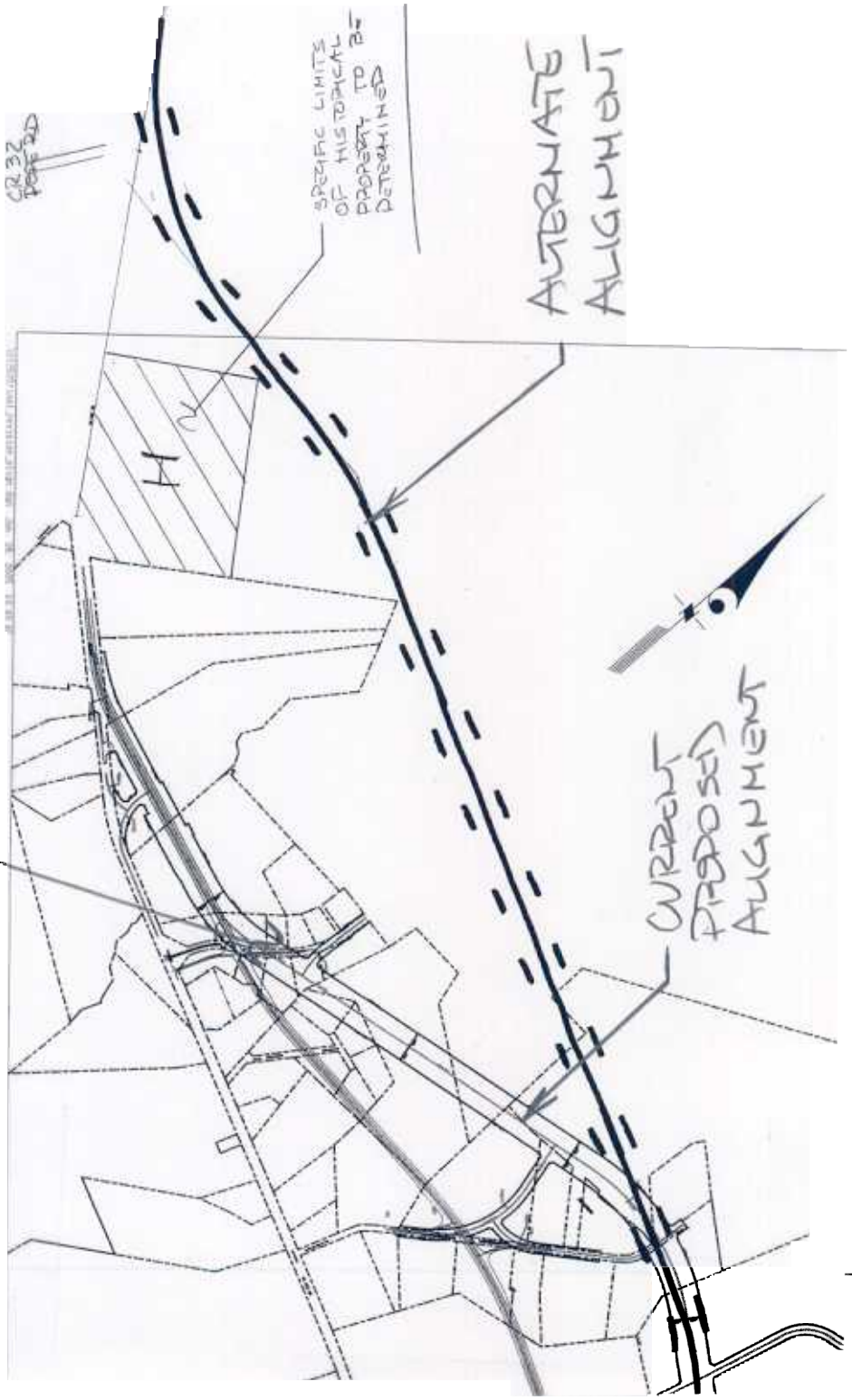
SKETCHES

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 16

☑ AS DESIGNED ☑ ALTERNATIVE

SHEET NO.: 2 of 4



CALCULATIONS

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17 / US 78 FROM SR 6 / SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 16

DESCRIPTION:

SHEET NO.: 3 of 4

ADDITIONAL LENGTH OF ROADWAY

3500 LF.

TOTAL LENGTH OF PROJECT = 9.556 MILES

= 50,455 ft

TOTAL COST – USE $30,000,000

COST PER LF $\frac{30,000,000}{50,455} = 595$ $/ft

USE 600 $/ft

ASSUME ABOUT 5 DISPLACEMENTS

@ 500,000 EACH

COST WORKSHEET

PROJECT: **EDS-545(53), PI NO. 222255**
WIDENING SR 17 / US 78 FROM SR 6 / SMITH HILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties

ALTERNATIVE NO: 16

DESCRIPTION

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Right-of-Way Displacements	EA	5	500,000	2,500,000			
Roadway Costs (20% reduction)	LF				3,500	600.00	2,100,000
Construction Mark-Up @ 27.34%	%					27.36%	574,560
Construction Subtotal							2,674,560
	Sub-total			2,500,000			2,674,560
Mark-up at				N/A			INCL
	TOTAL			2,500,000			2,674,560

VALUE ENGINEERING ALTERNATIVE

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17/US 78 FROM SR 6/SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

ALTERNATIVE NO.: 18

DESCRIPTION: **BALANCE THE EARTHWORK**

SHEET NO.: 1 of 1

ORIGINAL DESIGN:

The design does not address the issue of balancing the earthwork. Earthwork quantities in the estimate were only provided as lump sum items, making it difficult to determine the amount of excavation and fill requirements.

ALTERNATIVE:

Assure the earthwork is balanced to preclude the project from becoming either a "fill" or "haul" venture.

ADVANTAGES:

- Potentially reduces costs
- Takes advantage of existing materials
- Reduces overall construction time
- Precludes long hauls with excavation tailings or imported fill
- Reduces wear and tear on local roads

DISADVANTAGES:

- Requires finer tuning of the design, especially profiling
- Must locate staging site for excavation for fill purposes

DISCUSSION:

Balancing the earthwork should be viewed holistically for the entire length, not only to minimize haul roads and distances, but to maximize operations and reduce disruptions to local traffic.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE	**DESIGN SUGGESTION**		
SAVINGS			

PROJECT DESCRIPTION

NEED AND PURPOSE

The State Route (SR) 17 improvements are part of the Governor's Road Improvement Program (G.R.I.P.). This involves the multi-laning of this primary north-south corridor in east Georgia, serving as a catalyst for the development of the region. The improvements will aid in the economic development of sparsely populated rural areas and small towns along this route. Traffic carrying capacity will increase and safety and operational characteristics along this segment will improve.

DESCRIPTION OF THE PROPOSED PROJECT

The project proposes to widen SR 17/United State Route (US) 78 from County Route (CR) 6 (Smith Mill Road) to the north end of the Washington Bypass. The project will provide four, 3.60-meter (m) lanes with a 13.6m depressed grass median for the entire 16.42 kilometers (km) project length. Because of adverse horizontal and vertical conditions and to avoid historic resources, the alignment would bypass Aonia to the west and continue on a new location east of and parallel to SR 17/US 78 from about the Williams Leverett House to the Washington Bypass. Access would be regulated by permit along the entire existing roadway and partially limited along a portion of the new location. The proposed right-of-way varies from 64m to 76m. A new parallel 137m x 11.6m bridge will be constructed over the Little River and the existing bridge will be widened to 11.6m. The existing roadway will remain open to traffic during construction.

Existing Design Features:

Typical Section(s):	Two 3.60m lanes with 3m shoulders-rural.
Posted Speed:	90 kilometers per hour (kph).
Minimum Radius of Curve:	555m.
Maximum Grade:	5.0%.
Width of Right-of-Way:	Varies from 30.5m to 61m.
Major Structures:	Little River – Continuous steel stringer bridge: 137m long by 10.4m wide; priority rating of 2275 and sufficiency rating of 80.0.

Proposed Design Features:

Typical Section(s):	Four 3.60m lanes with 13.6m depressed grassed median - rural.
Design Speed Mainline:	105 kph.
Maximum Grade Mainline:	3.0%; maximum allowable 5.0%.
Minimum Radius of Curve:	555m; minimum allowable at 90 kph is 275m.
Right-of-Way:	Varies from 64m to 76m.
Structures:	Little River – Widen existing bridge and build one new bridge: 137m long by 11.6m wide.
Traffic Control during Construction:	Maintain one lane in each direction.
Environmental Concerns:	Historical parcels – houses, farmlands, cemetery, etc.

Permits Required:	Corps of Engineers 404; approximately 1.06 hectares of wetlands.
Utility Involvement:	Transmission Lines.

COST DATA

The current probable cost of construction is $29,139,051 as noted on the Preliminary Cost Estimate, EDS-545(53), McDuffie/Wilkes Counties, P. I. No. 222255, printed January 27, 2005. The project contains inflation at 5.00% per annum for three years (15.76%) and a contingency of 10.00%.

VALUE ANALYSIS AND CONCLUSIONS

GENERAL

This section describes the value analysis procedure used during the value engineering study. It is followed by separate narratives and conclusions concerning:

- Value Engineering Workshop Participants
- Economic Data
- Cost Estimate Summary and Cost Histograms
- Function Analysis
- Creative Idea Listing and Judgment of Ideas

A systematic approach was used in the VE study and the key procedures involved were organized into three distinct parts: 1) preparation; 2) VE workshop; and 3) post-study. A Task Flow Diagram that outlines each of the procedures included in the VE study is attached for reference.

PREPARATION EFFORT

Pre-study preparation for the VE effort consisted of scheduling study participants and tasks; gathering necessary background information on the facility; and compiling project data into a cost model and graphic cost histogram. Information relating to the design, construction, and operation of the facility is important as it forms the basis of comparison for the study effort. Information relating to funding, project planning operating needs, systems evaluations, basis of cost, soil conditions, and construction of the facility was also a part of the analysis.

VALUE ENGINEERING WORKSHOP EFFORT

The VE workshop was a three-day effort (see attached agenda). During the workshop, the VE job plan was followed. The job plan guided the search for high cost areas in the project and included procedures for developing alternative solutions for consideration. It includes six phases:

- Information Phase
- Function Identification and Analysis Phase
- Creative Phase
- Evaluation Phase
- Development Phase
- Presentation Phase *(Not conducted)*

Information Phase

At the beginning of the study, the conditions and decisions that have influenced the development of the project must be reviewed and understood. For this reason, the development manager presented information

Value Engineering Study Task Flow Diagram

Preparation Effort

Coordinate Project

- Verify Schedule
- Suggest Format for Designer Presentation
- Outline Project Responsibilities
- Outline Needed Background Data
- Establish Performance and Acceptance Requirements
- Conduct Coordination Meeting
- Identify Project Constraints

→

Prepare for Workshop

- Collect Project Data
- Distribute Data to Team Members
- Team Members Become Familiar with Project
- Visit Project Site

→

Construct Cost, LCC, Energy Models

- Construct Models
- Identify High Cost and Consumption Areas

Workshop Effort

Information Phase

- VETL Opens Workshop
- Designer Gives Project Description/Presentation
- Discuss Owner Requirements
- Review Project Data
- Visit Project Site (Alt.)
- Finalize Cost, LCC, Energy Models

→

Function Identification and Analysis Phase

- Perform Function Analysis
- Calculate Cost/Worth Ratios

List Ideas Generated During Function Analysis

→

Creative Phase

- VETL Introduces Creative Thinking
- Prepare Creative Idea Listing. Seek:
  - Quantity of Ideas
  - Association of Ideas
- Brainstorm
- Do Creative Thinking
  - Group Thinking
  - Individual Thinking

→

Evaluation Phase

- Eliminate Impractical Alternatives
- Rank Ideas with Advantages/Disadvantages
- Evaluate Alternatives (Include Non-Economic considerations: Safety, Reliability, Environment, Aesthetics, O & M, etc.)
- Select Best Ideas for Implementation

→

Development Phase

- Develop Proposed Alternatives
- Prepare Alternative Sketches
- Estimate Costs
- Perform Life Cycle Comparison
  - Initial Cost
  - Redesign Cost
  - O & M Cost
  - LCC Cost

→

Presentation Phase

- Summarize Findings
- Present VE Ideas to Owner/User/Designer
- Prepare VE Report

Post-Workshop Effort

Implementation Phase

- Develop Implementation Plan
- Designer Prepares Responses to VE Report
- Participate in Implementation Meeting with Owner/User/ Designer/VE Team, as needed
- Owner Evaluates and Selects Preferred Alternatives

→

Final Acceptance

- Redesign by Designer

about the project to the VE team on the first day of the session. Following the presentation, the VE team discussed the project using the following documents:

- *Value Engineering Study Package* for Project No. **EDS-545(53), P. I. No. 222255 entitled WIDENING OF SR 17/US 78 FROM SR 6/SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS**; McDuffie and Wilkes Counties; prepared by Clark Patterson Associates for the State of Georgia Department of Transportation, dated January 28, 2005; containing: (1) Approved Concept Report; (2) Construction Cost Estimate; (3) Typical Sections, (4) Construction Plan Sheet of Approved Concept Alignment; (5) Preliminary Bridge Plans, and (5) Layout of Proposed Revised Alignment
- *8½" x 11" Plan and Profile Drawings* for Project No. EDS-545(13), P. I. No. 262130 entitled Widening and Relocation of Washington Bypass from SR 17 North of Washington to SR 80, Wilkes County; prepared by the Department of Transportation, State of Georgia, Federal Route Number: None; State Route Number: 825; dated January 3, 1995; and
- *Internal Memorandum* for EDS-545(53)/PI 222255/McDuffie-Wilkes Co., from Tom Cox to Lisa Myers with information about a large historic site north of SR 17 about ½ mile south of the CR 28/Reynolds Road intersection and about the aerial photograph of the Washington Bypass; dated February 16, 2005.

Function Identification and Analysis Phase

Based on historical and background data, a cost model and graphic function analysis were developed for this project by major construction elements. They were used to distribute costs by project element; serve as a basis for alternative functional categorization; and assign worth to the categories, where worth is the least cost to provide the required function, as determined by the VE team. The VE team identified the functions of the various project elements and subsystems by using random function generation techniques resulting in the attached Random Function Analysis worksheet and/or Function Analysis Systems Technique (F.A.S.T.) diagram.

Creative Phase

This VE study phase involved the creation and listing of ideas. Creative idea worksheets were organized by project element. During this phase, the VE team developed as many ideas as possible to provide the necessary functions within the project at a lower cost to the owner, or to improve the quality of the project. Judgment of the ideas was restricted at this point. The VE team was looking for a large quantity of ideas and free association of ideas.

The Georgia Department of Transportation and the Clark Patterson Associates representatives may wish to review the creative list since it may contain ideas that can be further evaluated for potential use in the design.

Evaluation Phase

During this phase of the workshop, the VE team judged the ideas generated during the creative phase. Advantages and disadvantages of each idea were discussed to find the best ideas for development. Ideas found to be irrelevant or not worthy of additional study were discarded. Those that represented the greatest potential for cost savings or improvement to the project were then developed further.

The VE team would like to develop all ideas, but time constraints usually limit the number that can be developed. Therefore, each idea was compared with the present schematic design concepts, in terms of how well it met the design intent. Advantages and disadvantages were discussed, and each team member rated the ideas on a scale of zero to five, with the best ideas rated five. Total scores were summed for each idea and only highly-rated ideas were developed into alternatives. In cases where there was little cost impact, but an improvement to the project was anticipated, the designation design suggestion (DS) was used. The design team should review this listing for possible incorporation of ideas into the project.
The creative listing was re-evaluated frequently during the process of developing alternatives. As the relationship between creative ideas became more clearly defined, their importance and ratings may have changed, or they may have been combined into a single alternative. For these reasons, some of the originally highly-rated items may not have been developed into alternatives.

Development Phase

During the development phase, each highly rated idea was expanded into a workable solution. The development consisted of a description of the alternative, life cycle cost comparisons, where applicable, and a descriptive evaluation of the advantages and disadvantages of the proposed alternatives. Each alternative was written with a brief narrative to compare the original design to the proposed change. Sketches and design calculations, where appropriate, were also prepared in this part of the study. The VE alternatives are included in the section entitled *Study Results*.

Presentation Phase

The last phase of the VE study would have been to present the findings of the study. However, GDOT now conducts the presentation internally upon receipt of the report. The VE alternatives were screened by the VE team before draft copies of the *Summary of Potential Cost Savings* worksheets were provided to GDOT representatives. The VE alternatives were arranged in the same order as the idea listing sheets to facilitate cross-referencing.

POST-WORKSHOP EFFORT

The post-study portion of the VE study includes the preparation of this Value Engineering Study Report. Personnel from GDOT will analyze each alternative and prepare a short response, recommending incorporating the alternative into the project, offering modifications before implementation, or presenting reasons for rejection. Lewis & Zimmerman Associates, Inc. is available at your convenience as you review the alternatives. Please do not hesitate to call on us for clarification or further information as you consider an implementation approach.

VALUE ENGINEERING STUDY AGENDA

Lewis & Zimmerman Associates, Inc. (LZA) will conduct a 24-hour VE Study on the **EDS-545(53), P.I. No. 222255,** project located in McDuffie and Wilkes Counties, Georgia. It is expected the owner, the Georgia Department of Transportation (GDOT) and the design team of Clark Patterson Associates (CPA) will be available to make a formal presentation concerning the project at the beginning of the workshop and be available to answer questions during the VE study effort.

VE Study Agenda

The VE study will follow the outline described below and be conducted September 14 - 16, 2004. The study will be conducted in Rooms 274 (Monday and Tuesday) and 344 (Wednesday) in GDOT's General Office located at No. 2 Capitol Square Street, Atlanta, Georgia 30334. The point-of-contact is Ms. Lisa L. Myers, Design Review Engineer Manager, who can be reached at 404-651-7468.

Monday, February 14th

9:00 am - 9:15 am **General Introduction of all Parties and review of the VE Process**

9:15 am - 11:15 am **Owner's / Designer's Presentation**

GDOT and CPA are to present information concerning the project including, but not necessarily limited to: rationale for design; criteria for specific areas of study, project constraints and the reasons for design decisions.

11:15 am - 12:00 noon **Commence Function Analysis Phase**

The VE team will continue their familiarization with the cost models and project data for each area of study. The cost model(s) will be refined, as necessary; define the function of each project element or system in the cost model, select the primary or basic functions, and determine the worth, or least cost, to provide the function. Cost / worth or value index ratios will be calculated, and high cost / low worth areas for study identified. In addition, the VE team will continue defining the function of each element / system to gain a thorough understanding of the project's needs and requirements.

12:00 noon - 1:00 pm **Lunch**

1:00 pm - 5:00 pm **Conclude the Function Analysis Phase and Commence the Creative Phase**

The VE team will conduct a brainstorming session and list as many ideas as possible for consideration. The aim is to obtain a large quantity of ideas through free association, by eliminating roadblocks to creativity and deferring judgment.

Tuesday, February 15th

8:30 am - 10:00 am **Conclude Creative Phase and Complete Evaluation / Analytical Phase**

The VE team will analyze the ideas listed in the creative phase and select the best ideas for further development.

10:00 am - 12:00 noon **Development Phase**

VE team will develop creative ideas into alternate design solutions. Initial and life cycle cost estimates comparing original and proposed alternatives will be prepared. Selected alternatives for change will be developed and supported with sketches, calculations and written substantiation.

12:00 noon - 1:00 pm **Lunch**

1:00 pm - 5:00 pm **Continue Development Phase**

Wednesday, February 16th

8:30 am - 12:00 am **Continue Development Phase**

12:00 noon - 1:00 pm **Lunch**

1:00 pm - 4:00 pm **Conclude Development Phase and Commence Summary Worksheets**

Upon completion of the Development Phase, the VE facilitator will commence preparation of the summary worksheets based on the alternatives developed by the VE team. The summary work sheets form the basis of the informal oral presentation.

4:00 – 5:00 pm **Finalize Summary Worksheets**

The VE team will provide draft copies of the *Summary of Potential Cost Savings* worksheets to GDOT representatives and be available to clarify any points.

VALUE ENGINEERING WORKSHOP PARTICIPANTS

The VE team was organized to provide specific expertise on the unique project elements involved. Team members consisted of a multidisciplinary group with professional design experience and a working knowledge of VE procedures. The VE team included the following professionals:

George A. Obaranec, PE	Civil/Roadway Engineer	Delon Hampton & Associates, Chartered
Gregory C. Grant, PE	Director, Structural Engineering, Bridge Engineer	HNTB
Edward F. Culican, Jr., PE	Senior Project Manager, Transportation/Roadway Engineer	HNTB
Luis M. Venegas, PE, CVS, LEED™ AP	VE Facilitator	Lewis & Zimmerman Associates, Inc.

OWNER'S/DESIGNER'S PRESENTATION

Representatives from the Georgia Department of Transportation and the Clark Patterson Associates design team presented an overview of the project on Monday, February 14, 2004. The purpose of this meeting, in addition to being an integral part of the Information Gathering Phase of the VE study, was to bring the VE team "up-to-speed" regarding the overall project. Additionally, the meeting afforded the design team the opportunity to highlight in greater detail those areas of the project requiring additional or special attention.

VALUE ENGINEERING TEAM'S FINAL PRESENTATION

The VE team did not conduct a final, oral presentation on Wednesday, February 16, 2004. However, copies of the draft *Summary of Potential Cost Savings* worksheets were provided for interim use by GDOT and CPA personnel.

A copy of the meeting participants is attached for reference.

VALUE ENGINEERING ATTENDEES

MEETING PARTICIPANTS

PROJECT:	EDS-545(53), PI No. 222255 WIDENING OF SR 17/US 78 FROM SR 6/SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS McDuffie and Wilkes Counties *Concept Development*	Date: February 14 – 16, 2005
NAME & E-MAIL (PLEASE PRINT)	**ORGANIZATION/TITLE**	**PHONE/FAX**
Thomas Cox em: tom.cox@dot.state.ga.us	State of Georgia Department of Transportation, (GDOT) Office of Consultant Design Consultant Liaison Engineer, Project Manager	ph: 404-463-7486 fx: 404-463-6136
Jennifer E. Mathis em: jennifer.mathis@dot.state.ga.us	GDOT, Office of Environmental/Location Environmental Analyst	ph: 404-699-6882 fx: 404-699-4440
Gerald A. Milligan em: jerry.milligan@dot.state.ga.us	GDOT, Right-of-Way Estimator Supervisor Appraisal	ph: 770-986-1541 fx: 770-986-1542
Lisa L. Myers em: lisa.myers@dot.state.ga.us	GDOT, General Office (GO) Design Review Engineer Manager	ph: 404-651-7468 fx: 404-463-6131
W. Scott Stephens em: scott.stephens@dot.state.ga.us	GDOT, District 2 – Tennille Area Engineer	ph: 706-855-3466 fx: 706-855-3479
Efren Dilidili, PE em: edildili@clarkpatterson.com	Clark Patterson Associates (CPA) Associate	ph: 770-831-9000 fx: 770-831-9243
Adolfo A. Guzman, PE em: aguzman@clarkpatterson.com	CPA Principal	ph: 770-831-9000 fx: 770-831-9243
George A. Obaranec, PE em: gobaranec@delonhampton.com	Delon Hampton & Associates, Chartered Project Manager	ph: 404-524-8030 fx: 404-524-2575
Gregory C. Grant, PE em: ggrant@hntb.com	HNTB Director, Structural Engineering, Bridge Engineer	ph: 770-956-5770 fx: 770-956-5779
Edward F. Culican, Jr., PE em: eculican@hntb.com	HNTB Senior Project Manager	ph: 770-923-7775 fx: 770-279-9297
Luis M. Venegas, PE, CVS-Life, LEED™ AP em: lmvenegas@aol.com	Lewis & Zimmerman Associates, Inc. Value Engineering Facilitator	ph: 770-992-3032 fx: 770-435-2666

ECONOMIC DATA

The VE team developed economic criteria to evaluate the with information gathered from the Georgia Department of Transportation and Clark Patterson Associates. To express costs in a meaningful manner, the VE team alternatives are presented on the basis of discounted present worth. Criteria for planning project period interest rates are based on the following parameters:

Year of Analysis:	2005
Construction Start-Up:	2008
Construction Duration:	±24 – 30 Months (2010 – 2011)
Economic Planning Life: Economic Planning Life:	35 years 50 years
Discount Rate/Interest:	2.25% (Latest United States Office of Management and Budget Circular A-94)
Inflation/Escalation Rate:	3.00% (CPA)
Uniform Present Worth (UPW) Factor:	21.4872 for 35 years 25.7298 for 50 years
Cost of Power:	$0.07/kWHr (kilowatt hour) (assumed)
Operation and Maintenance Costs *(Industry Norms)*:	
Equipment - With Many Moving Parts	5.00%-5.50%+ of Capital Cost
Equipment - With Minimal Moving Parts	3.50%-4.00% of Capital Cost
Equipment - Electronic	3.00% of Capital Cost
Structural	1.00%-2.00% (or less) of Capital Cost
Composite Mark-Up from Construction Subtotal to Grand Total: *(Composed of: Inflation [based on 3.00% per annum for three years] at 15.76%; Contingency at 10.00%; $4,228,000 of ROW and $63,000 of Reimbursable Utilities)*	49.33% (1.4933)
Composite Mark-Up from Construction Subtotal to Construction Total: *(Composed of: Inflation [based on 3.00% per annum for three years] at 15.76%; Contingency at 10.00%)*	27.34% (1.2734)
Composite Mark-Up from Construction Total to	

Grand Total: *(Composed of: $4,228,000 of ROW and $63,000 of Reimbursable Utilities)*	17.27% (1.1727)

COST ESTIMATE SUMMARY AND COST HISTOGRAMS

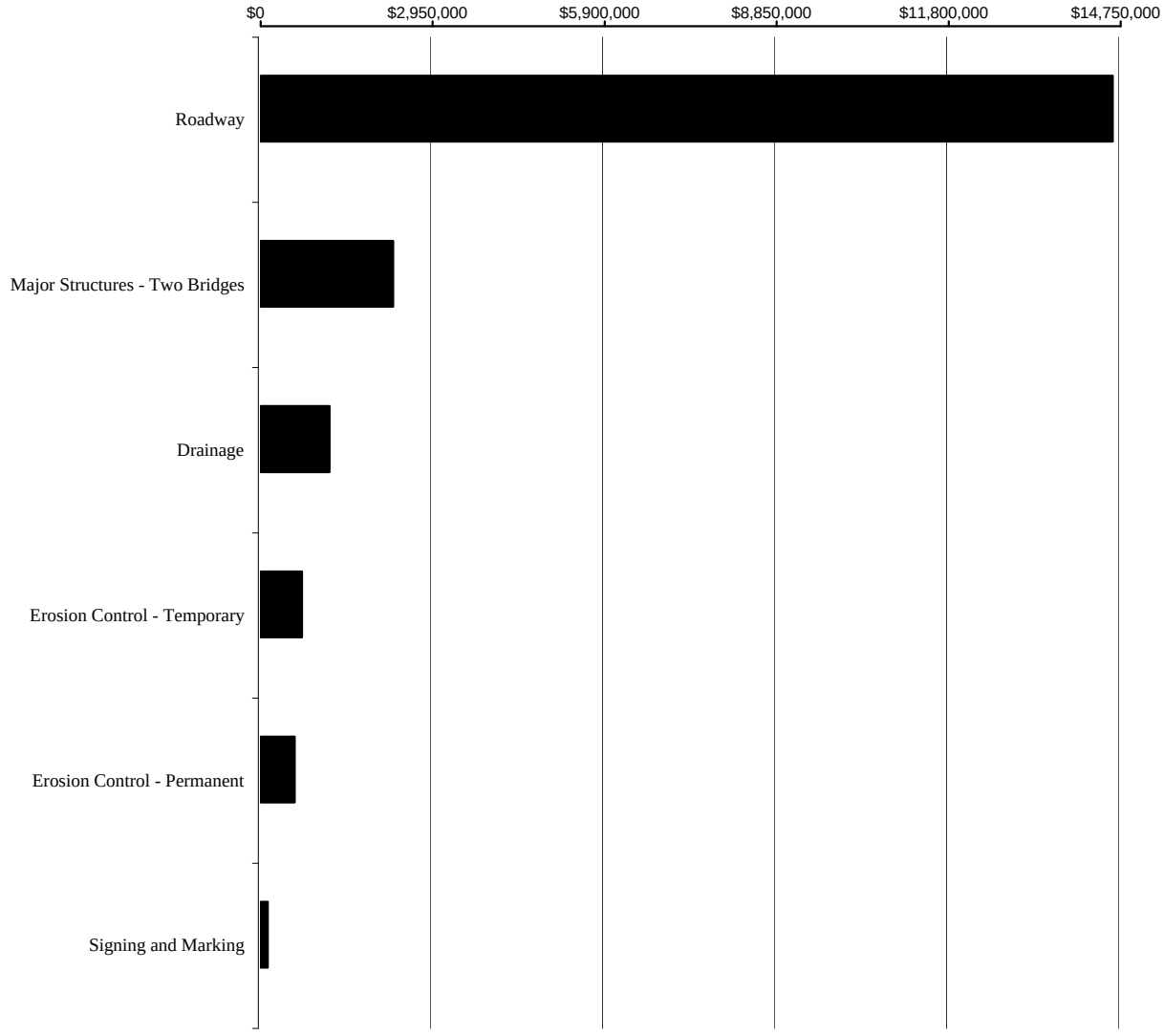
The VE team prepared a cost model for the project that is included following this page. The cost model is arranged in the Pareto Charting/Cost Histogram format to identify high cost areas and is based on the *Preliminary Cost Estimate, EDS-545(53), McDuffie/Wilkes Counties, P. I. No. 222255,* prepared by Clark Patterson Associates, the design consultant. As can be expected, judgments at this stage of the study is based on experience and intuition rather than facts, which are not uncovered until well along in the analysis of function. As a result of these qualified hypotheses, there appears to be a potential for initial savings in the following areas:

- Roadway;
    - Unclassified Excavation
    - Graded Aggregate Base Course, Including Materials
    - Recycled Asphalt Concrete
    - Guardrail
- Bridges; and
- Drainage.

COST HISTOGRAM

PROJECT: EDS-545(53), P. I. N0. 222255
WIDENING OF SR 17/US 78 FROM SR 6/SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

TOTAL PROJECT		COST	PERCENT	CUM. PERCENT
Roadway		14,619,575	74.92%	74.92%
Major Structures - Two Bridges		2,277,000	11.67%	86.59%
Drainage		1,187,409	6.08%	92.67%
Erosion Control - Temporary		714,651	3.66%	96.34%
Erosion Control - Permanent		587,889	3.01%	99.35%
Signing and Marking		127,217	0.65%	100.00%
Construction Subtotal		**$ 19,513,768**	**100.00%**	
Inflation - Based on 5.00% per annum for 3 years@	15.76%	$ 3,075,370		
Contingency @	10.00%	$ 2,258,914		
Construction Total		**$ 24,848,052**		
Right-Of-Way		$ 4,228,000		
Reimbursable Utilities - Transmission Lines		$ 63,000		
GRAND TOTAL		**$ 29,139,052**		
Composite Mark-up from Construction Subtotal to Grand Total:				*49.33%*
Composite Mark-up from Construction Subtotal to Construction Total:				*27.34%*



Costs in graph are not marked-up.

FUNCTION ANALYSIS

A function analysis was performed to: (1) define the requirements for each project element, and (2) to ensure a complete and thorough understanding by the VE team of the basic function(s) needed to attain a given requirement. A *Random Function Analysis* worksheet for the project is attached. This part of the function analysis stimulated the VE team members to think in terms of the areas in which to channel their creative idea development.

Function analysis is a means of evaluating a project to see if the expenditures actually perform the requirements of the project, or if there are disproportionate amounts of money spent on support functions. These elements add cost to the final product, but have a relatively low worth to the basic function.

The Random Function Analysis effort identified the project's basic functions as:

CONTINUE/G.R.I.P. and ENCOURAGE/ECONOMIC DEVELOPMENT by Connecting/Corridor, Widening/Road, Increasing/Capacity, Acquiring/ROW and Increasing/Design Speed.

RANDOM FUNCTION ANALYSIS

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17/US 78 FROM SR 6/SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

SHEET NO.: 1 of 1

DESCRIPTION	FUNCTION		
	VERB	NOUN	KIND
WIDENING OF SR 17/US 78	Continue	G.R.I.P.	B
	Encourage	Development	B
	Connect	Corridor	B_1
	Preserve	History	RS
	Facilitates	Economic	B_1
	Move	Traffic	S
	Improve	Safety	RS
	Widen	Road	B_1
	Increase	Capacity	B_1
	Span	River	RS
	Limit	Access	S
	Ease	Seasonal Traffic/ Congestion	S
	Improve	Alignment	RS
	Acquire	Right-of-Way	B_1
	Increase	Design Speed	B_1

Function defined as: Action Verb, Measurable Noun

Kind: B = Basic; S = Secondary; RS = Required Secondary; HO = Higher Order; LO = Lower Order; O = Objective; G = Goal; U = Unwanted

CREATIVE IDEA LISTING AND JUDGMENT OF IDEAS

During the creative phase, numerous ideas, alternative proposals and/or recommendations were generated using conventional brainstorming techniques as recorded on the following pages.

These ideas were then discussed and the advantages/disadvantages of each listed. The VE design team compared each of the ideas with the concept solution determining whether it improved value, was equal in value, or lessened the value of the solution.

The ideas were then ranked on a scale of one to five on how well the VE design team believed the idea met necessary criteria and program needs. The higher rated ideas were then developed into formal alternatives and included in the VE workshop. Some ideas were judged to have minimal cost impacts on the project but provided enhancements in the form of improved operations, efficiency, constructibility or potential to save unknown or hidden costs. These were given the designation "DS" which indicates a design suggestion. This designation is also used when an idea is difficult to price but improves the functionality of the project or system, and is deemed to be of significant value to the owner, user, operator, or designer.

Typically, all ideas rated four or above are included in the Study Report. When this is not the case, an idea was combined with another related idea or discarded, as a result of additional research that indicated the concept was not cost-effective or technically feasible.

The reader is encouraged to review the *Creative Idea Listing and Evaluation* worksheets since they may suggest additional ideas that can be applied to the design.

CREATIVE IDEA LISTING

PROJECT: **EDS-545(53), PI No. 222255**
WIDENING OF SR 17/US 78 FROM SR 6/SMITH MILL ROAD TO SOUTH END OF WASHINGTON BYPASS
McDuffie and Wilkes Counties
Concept Development

SHEET NO.: 1 of 1

NO.	IDEA DESCRIPTION	RATING
1	Do nothing	2
2	Jack and reuse the existing bridge	4
3	Remove the two "S" curves at the beginning of the project	3
4	Optimize the bridge design	4
5	Keep the existing bridge as-is and construct a new parallel bridge	4
6	Eliminate the intersection north of the Williams Leverett House	4
7	Grade separate SR 17/US 78 north of the treatment plant and eliminate the connection/access to SR 17/US 78	1
8	Eliminate the intersection at Reynolds Road	4
9	Eliminate the limited access attribute	4
10	Simplify Bellwood Road alignment/intersection	5
11	Realign the north end of the project to miss/avoid the existing subdivision (Combine with Alternative 12)	4
12	Eliminate the broken-back curve near Upton Mill Road; eliminate the Upton Mill Road intersection; provide a continuous curve from the Washington Bypass (Combine with Alternative 11)	4
13	Create a one-way pair at the north end of the project; i.e., the existing alignment and the new alignment	5
14	Reduce the design speed, change the typical section by using curb and gutter with four lanes and a 20-ft. raised median to just north of the Williams Leverett House	4
15	Shift the existing alignment to the west in lieu of the east	DS
16	Project SR 17/US 78 north of the existing subdivision and tie to the Washington Bypass beyond the large historic land parcel	4
17	Use the original alignment at the north end of the project	3
18	Balance the cut and fill	DS
19	Create a one-way pair at the north end of the project; i.e., the existing alignment and the new alignment on the west side	DS

Rating: 1®2 = Not to be Developed; 3®4 = Varying Degrees of Development Potential; 5 = Most likely to be Developed;
DS = Design Suggestion; ABD = Already Being Done; N/A = Not Applicable